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AIRCRAFT

1/-

Incorporating "Slipstream"

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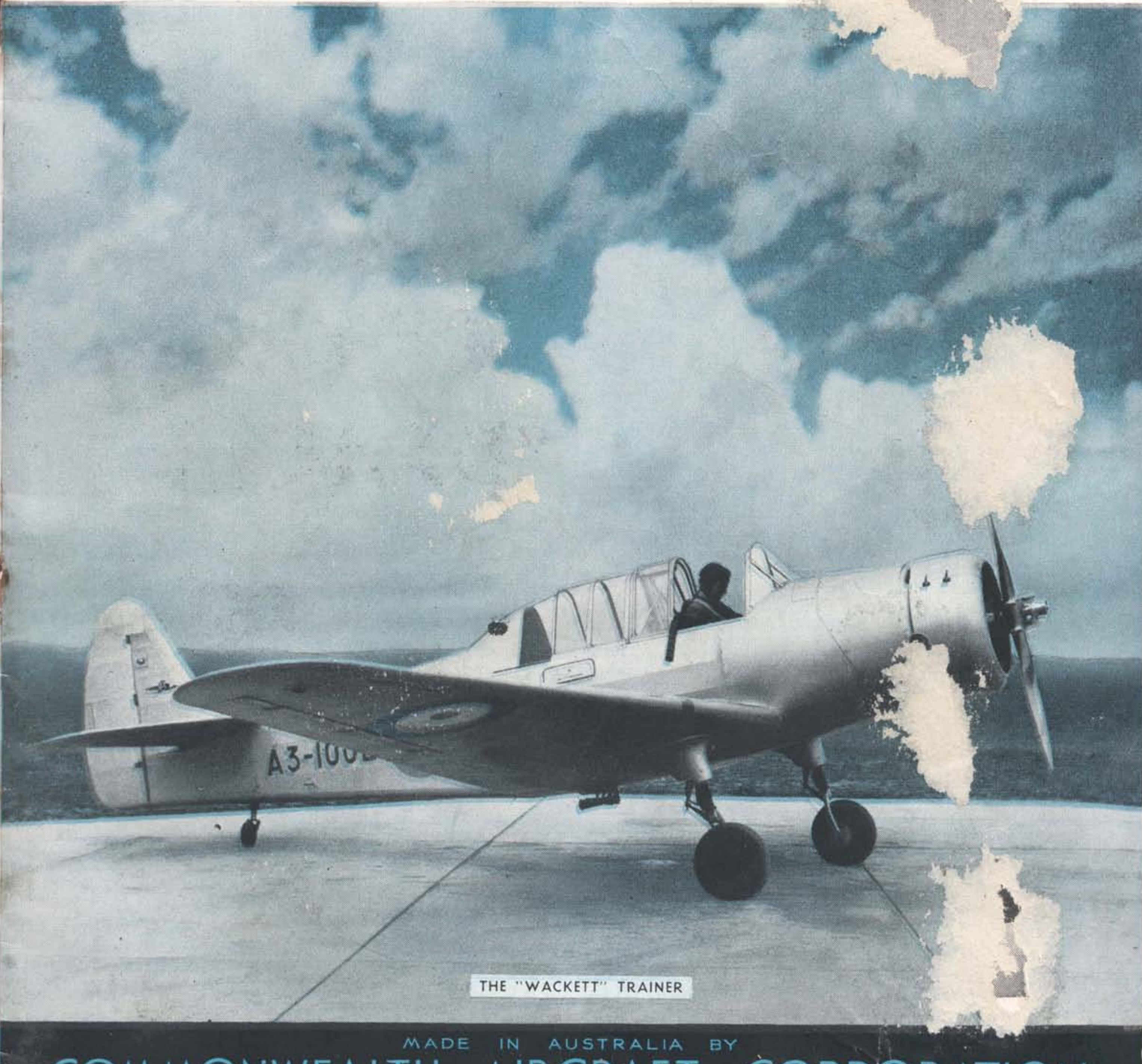
SEPTEMBER, 1942



THE "WACKETT" TRAINER


Say, how do you feel in your Parasuit? over..
" Over to you, old boy—this ' Parasuit ' is the answer to a poor flying man's prayer . . . it gives me more elbow room than I've ever dreamed of, it doesn't make me feel like a portmanteau, and when I think of some of the hatches . . ." " Speaking as an operator, I can nip about now like a two-year-old in this cabin, for it doesn't stick out in the wrong places."
" Yes, it's wizard. I took the trouble to do a bit of weights and measures yesterday. The whole outfit weighs only 23 lbs, and that built-in parachute only measures 1½" thickness."
" Well, as I was saying, I was talking to a chap who dropped into the drink the other day wearing his ' Parasuit.' He said, the incorporated buoyancy stole made his dip a luxury job—kept him high if not dry till the launch hove in sight."
" Sure, this Parasuit with its streamline is just the chute for tight corners—in more senses than one."
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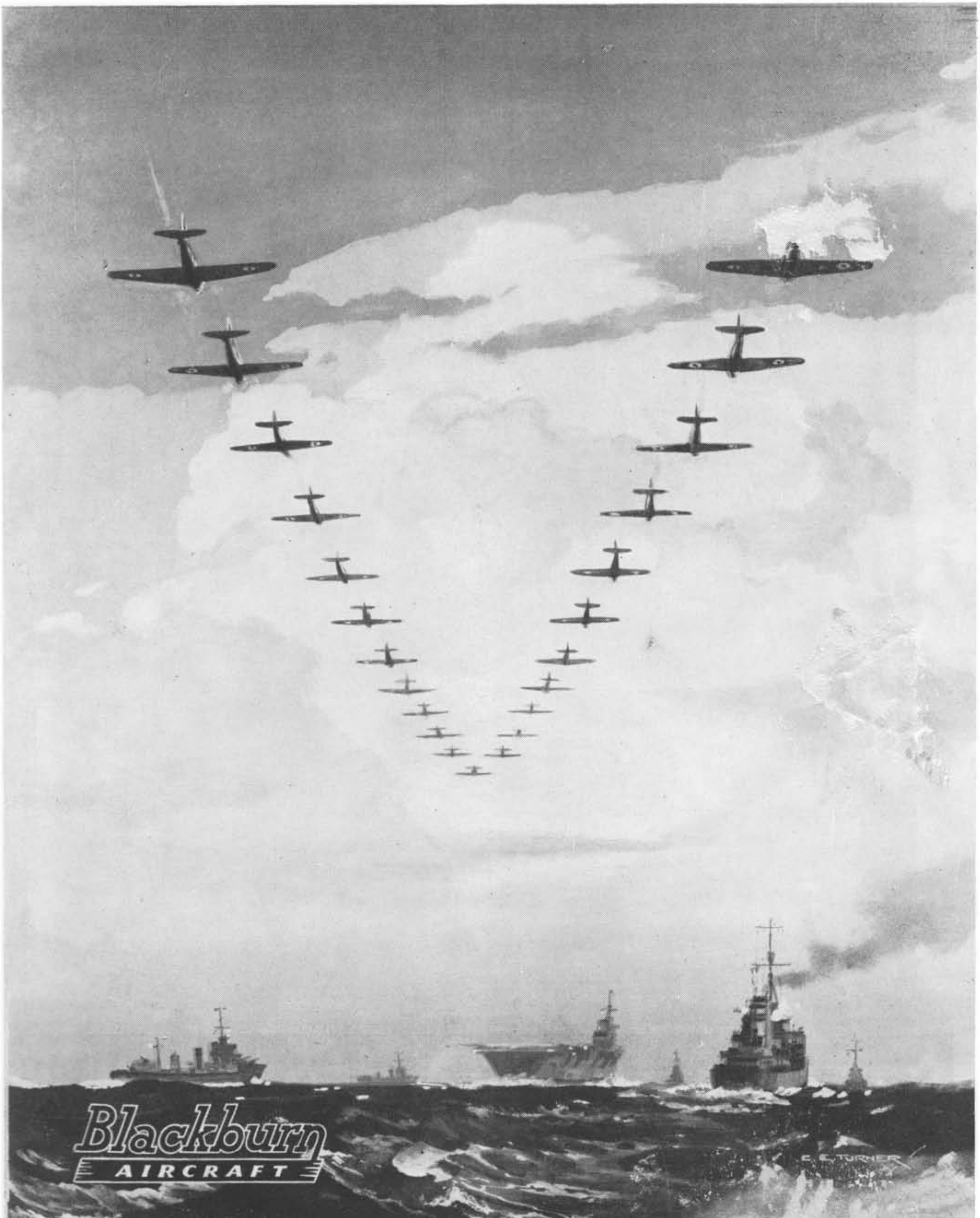

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AIRCRAFT

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Aircraft

INCORPORATING SLIPSTREAM

FOUNDED 1918

MORE NEWS MAKES BETTER MORALE

UNDER the heading, "Telling the World," Flight of May 28, carries this paragraph:

Australians seem to be somewhat dissatisfied with their own official handling of R.A.A.F. news, to judge by editorial comment in Aircraft, which is the oldest aviation journal in the Southern Hemisphere.

This journal says that, although individuals with aviation contacts know of the grand work the pilots and aircrews of the R.A.A.F. have been doing over a wide area, the public is told so little in the officially issued news that it thinks Australia's airmen are playing rather a feeble part.

There is also some indication, it says, that the R.A.F. habit of suppressing the names of officers and men in news items is being copied by the R.A.A.F., but that "most people are heartily sick of the constant use of Ministers' names attached to the slightest piece of news."

Well-told stories of their airmen's gallant fights, giving names, would, it adds, be the finest possible tonic for public morale.

Maybe they've got something there!

From time to time, Aircraft has criticised the public relations policy of the Royal Australian Air Force. It is comforting to know that such a journal as Flight, one of the oldest and most influential aviation magazines in the world, closely in touch with the R.A.F. and first to support any reasonably-based Service tradition, is in agreement with us.

The ban on publication of names of pilots interviewed by war correspondents has had one particularly bad effect in Australia. It has given the Australian public the idea that the war in the north has been fought and is being fought almost entirely by Americans. As its editorial policy has shown clearly, Aircraft is highly appreciative of what the Americans have done and of the way the Americans do many things. But Aircraft also believes that for the sake of Australia's self-respect, and for the morale of the Royal Australian Air Force, it is essential that the public should be told what Australians are doing, too.

War correspondents find the R.A.A.F. very difficult to deal with. Individual officers are frequently most helpful, and the Department of Public Relations does what it can. But somewhere or other along the line comes in the influence of the anti-press gang, which probably dates back to the days when all flying men distrusted all newspapermen, because they believed, quite wrongly, that all the newspapers wanted was stories of crashes.

The theory behind the anonymity portion of this shrinking violet business is that if a pilot is mentioned by name he is likely to be built up as a popular hero, whereas other men who have not been in the limelight but have perhaps done even better work are overlooked; that it leads to one man getting the credit instead of the team; and that both these things are bad for morale.

There might be, and in fact there have been cases in which false heroes have been made and injustices have been done. But the morale of the Service ought to be good enough to prevent any damage done in this way. It is unlikely that if the Press did the worst it could, morale would be damaged as much as it is by artifiicial distinction between officers and non-commissioned officers doing identical work. And in any case, the Press is so willing to co-operate with the Services that there need be no trouble at all. Discussion between Service representatives and war correspondents, and if necessary editors, could prevent the sort of thing that might be harmful.

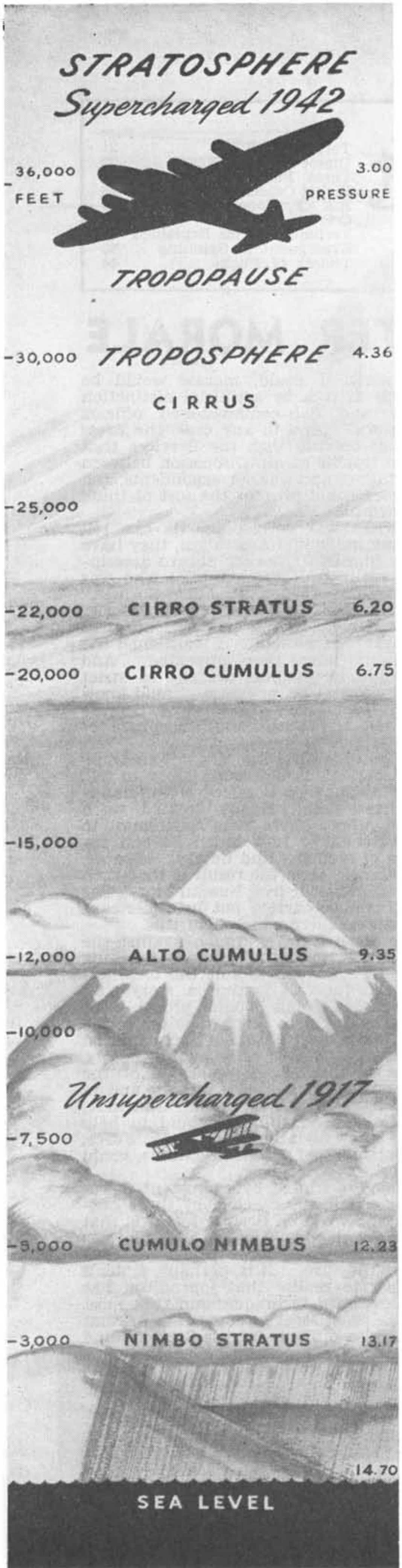
At present, when war correspondents can tell a story about some individual Australian, they have to try to identify him by some such absurd description as "an unusually tall sergeant-pilot who was formerly an alligator-breeder at Alice Springs." American correspondents just won't touch stories like that. To their readers, a name alone gives the touch of truth! If no name is mentioned the whole story might have been invented. And although Australian newspapers are not so strict on this point—they can't be, or no one would know that we had an air force—this lack of definite identification gives air stories an atmosphere of unreality to the reader.

If an American outfit has done something notable, or an American leader has a story to tell, it is not done by means of a Service-vetted "hand-out." Instead, correspondents are invited to a Press conference, where there is a spokesman to tell his story. He knows how much he can say within the limits of security, and he says no more. He answers questions. And the result is that each correspondent gets his own live, human story. The raid on the Philippines, carried out by Americans based here, was an excellent example of this.

Flying people often have a grouch against the Press because it does not handle stories touching on technicalities in a fashion to suit the technical man. One reason for this is that a story that satisfied the technical man would probably be Greek to the general reader. The reporter is the interpreter. He knows just how much explanation the public will take. But to do his job properly, the reporter has to understand something of the subject. Civil aviation had this complaint and in America, and to some extent in Britain and here, got over it by doing everything it could to help reporters get to know aviation. The Air Force, through its Department of Public Relations, could do the same thing.

This department is staffed by competent newspapermen. The conclusion reached by those outside the Service who write on Service topics is that the Air Force is not guided by the men it employs as experts, or its public relations would not be conducted in the way they are. It is, perhaps, difficult for a Staff Officer to realise that journalism has its own highly-developed technique, and that most of the men who practise it are experts in that technique. It is also difficult for the Service mind to realise that effective presentation of the news can do a very great deal to win the war.

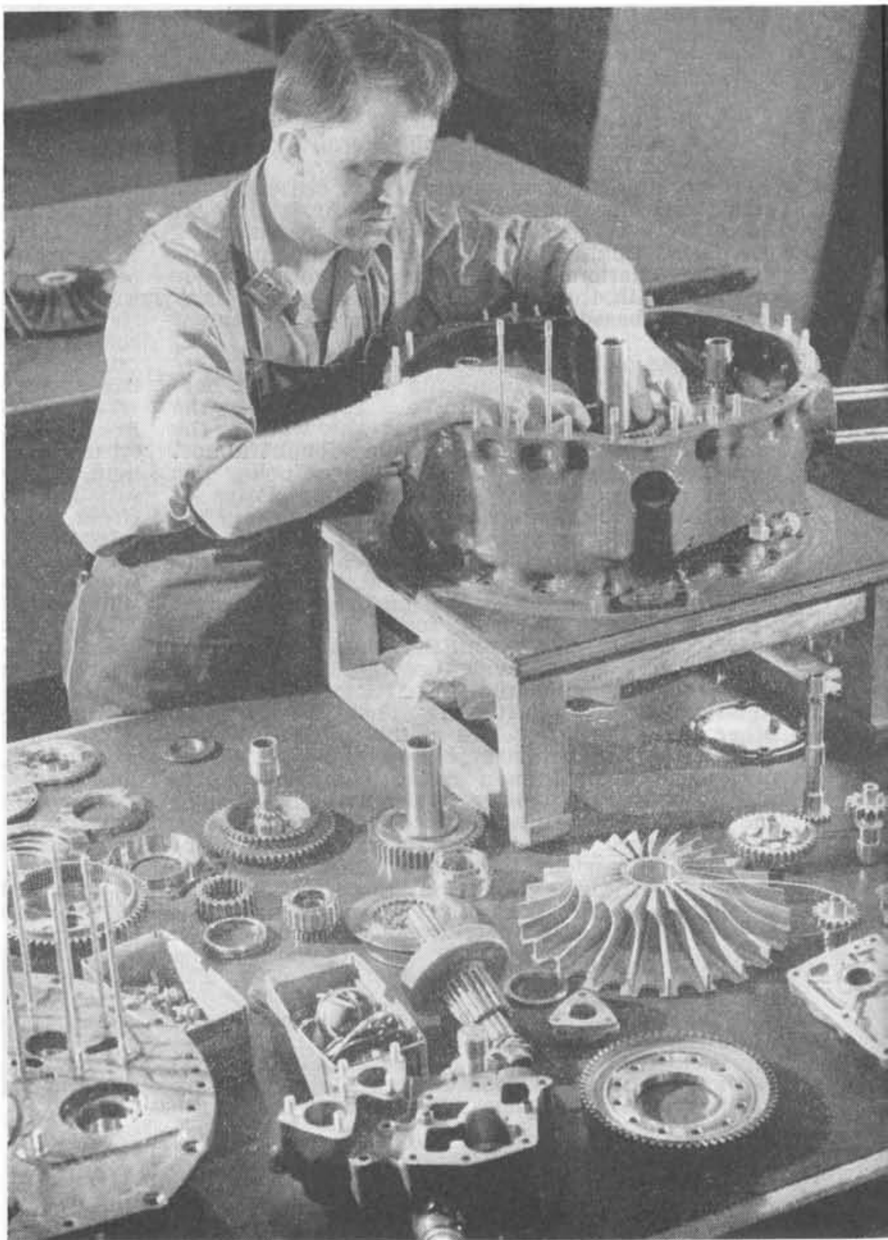
Certainly a better service of news and photograps from R.A.A.F. stations in forward areas—photographs of R.A.F. stations and of raids on Europe are far easier to get than pictures from our own war areas—would help the morale of Australia.

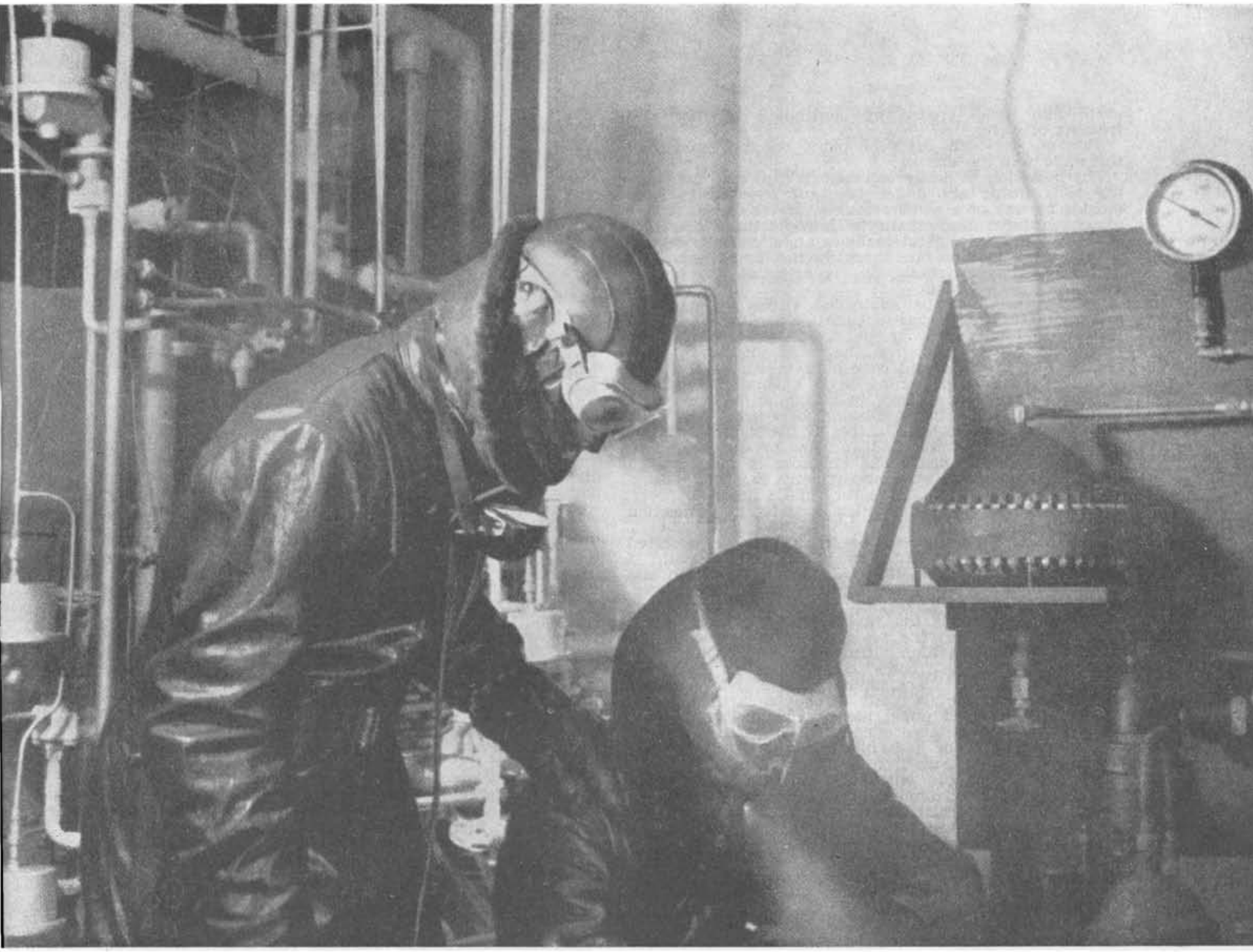


The Search for ALTITUDE

How Polar laboratories solve problems of the effect of stratosphere flying on men and machines.

Skilled workman assembling the precise and intricate machinery of a supercharger at the Wright Aeronautical Corporation's plant. Whirling at a speed about 20 times that of the airscrew, the Rotor sucks in air for the engine in the lower stratosphere to restore approximately sea level pressure.





Inside the Polar laboratory of the Boeing works where Flying Fortress experiments are carried out in a temperature of —70 deg. F. and low pressure corresponding to the lower stratosphere.

THE fundamental condition for the successful prosecution of modern air warfare rests with the utilisation of high performance aircraft and the employment of a highly skilled flying personnel. Because high altitude flying provides definite tactical advantages, its application to air warfare is rapidly growing. In short, the key word in aviation today is altitude.

This ascent into the upper regions of the atmosphere unfolds many new problems, both physiological and technical.

Great heights—first mountains and later the upper airlanes—have long withstood man's conquest. Lack of oxygen for them to "breathe" in the rarefied upper atmosphere restrained both man and his engines until oxygen could be supplied in concentrated form to utilise their energies.

Man now uses "bottled" oxygen; the oxygen for the engines is concentrated by a mighty midget of an air pump known as a supercharger.

But firstly let us deal with the grand experiments aspect and what has been accomplished to date. Portion of the report of a R.A.F. bomber pilot will serve to introduce this subject.

His Flying Fortress had bumped into trouble on the way home and had picked up a few Nazi machine-gun bullets. The pilot had brought the aircraft back safely enough, but one of the lead souvenirs had gone through the tyre of the tail wheel. The tyre was not merely *punctured*. It was *shattered*, like so much chinaware.

The cause was simple enough, for the fighting had been several miles "upstairs," where the weather is somewhat cooler than a summer day at Manly. It is cool enough to freeze rubber tyres into hard rock, an event which is presumed to occur at a temperature of about minus 50 degrees Fahrenheit.

This recent R.A.F. event is only one of many strange things that happen to materials, equipment, and human beings at high altitudes, and that is why "cold rooms" and strato-chambers are now widely adopted.

The cold room enables engineers to manufacture the same low temperatures they would find should they climb up into the stratosphere. Furthermore, such a laboratory combines low temperatures with the low pressures found at high altitudes and even provides the vibrations to equipment that would occur in actual flight.

The combination of all these things, along with other features, makes the Boeing Company's Strato-lab. in America unique.

Their polar lab. is operated by the largest mechanical refrigeration machine in use anywhere for atmospheric aviation research. You could freeze as many ice cubes with this machine as you could in twelve hundred medium-sized house refrigerators. In engineering language, the capacity of the laboratory is 108,000 B.T.U. (British thermal units) per hour.

The way the engineers built the arctic house would shock a carpenter. They started with the ceiling and worked down. They managed this seeming defiance of gravity by attaching the roof of the cold room to the ceiling of the larger room in which the cold lab. was built.

Engineers presently discovered that air from outside was sneaking into the room. Air within the room contracted as the temperature dropped, and the relatively lower pressure permitted outside air to seep through the cork walls. Moisture in the outside air condensed and froze within the walls. Failure to plug the leak eventually would cause the walls to disinte-

grate like rocks eroded by continuous melting and freezing of water.

Two quarter-inch coats of paint on the outside of the walls was the answer.

The polar lab. is dangerous enough that men conducting tests inside are under constant observation from outside by way of a window four layers thick, each pane separated from the others to provide three dead air spaces. Wearing apparel includes an electrically-heated flying suit, grotesque face mask, helmet and fleece-lined boots. An oxygen mask also is essential, for no air enters the sealed room.

Temperature may be controlled either manually or by automatic thermostat outside. Operator and man inside communicate by telephone. Aircraft parts and equipment are brought into the room through a large double door of wood and cork built in one of the long walls. The personnel entrance is at one end of the structure. Like an air lock in a submarine, it consists of two doors with an "ante-room" between.

There is an arctic section, too, in the strato-chamber, and it is here that the cold and low pressures of high altitudes are combined. The chamber is made up of three compartments: two compartments in a single tank, joined by a hatch that looks very like a manhole cover, and a third compartment which operates in connection with the cold room.

This one can be joined to the others or operated separately. It is insulated by a cork blanket and a portable cork end panel that is rolled into position and clamped in place when low temperatures are required. With its cold supply originating in the same huge refrigeration machine that keeps the cold room going, it is possible to run the scale of temperatures for all conditions found at high altitudes.

One or two of the "rooms" can be used as the cabin, with the remaining space simulating the great outdoors of the stratosphere. Or all three compartments can be operated together under identical conditions.

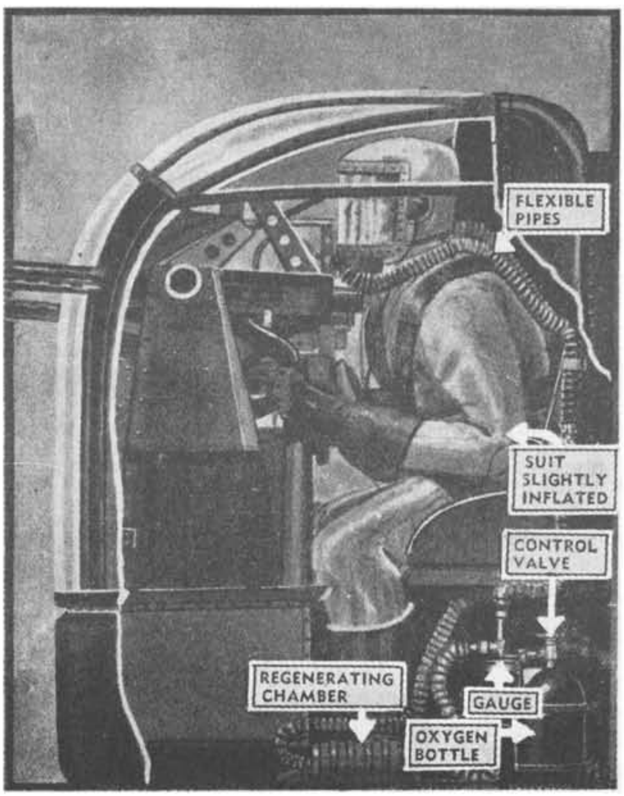
The laboratory is large enough to test complete heating, supercharging or hydraulic systems. It is equipped for dual operation, both from outside and inside.

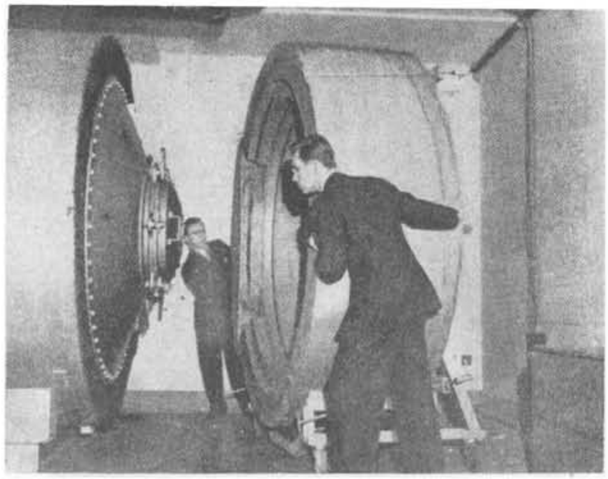
A pair of Ford V8 engines turn centrifugal supercharging units that circulate the air between compartments, while an electrically-driven vacuum pump sucks air out to create low pressure conditions.

Results of tests already completed in the Strato-Lab. have shown that many items of purchased equipment, and even entire systems, often must be redesigned for most efficient operation at high altitudes. Sometimes new materials must be developed.

The weather already can be made so cold in both the polar room and the refrigerated end of the strato-

Pilot's pressure and oxygen suit for use at high altitudes.





Sealing the end of Boeing's strato-lab.

chamber that the mercury barometers and manometers ordinarily used to indicate absolute and differential pressures respectively are stopped far short of the bottom.

Mercury freezes at approximately minus 39 degrees; so alcohol has replaced it in the lab. Even mechanical instruments must be specially designed if they are going to be of any use in the chill temperature of the strato-lab.

As an example of what cold does, these products freeze at the following temperatures:—

Glycol, plus 11; neoprene artificial rubber, —15; glycerine, —40; aircraft hydraulic fluid, —50; light machine oil, —50; pure para rubber, —65; kerosene, —70.

The very best grade of anti-freeze mixed with water, the combination that has kept the frost-bite from numerous cars through the winter, will succumb at minus 40, while even the gasoline will freeze at minus 90, which matches the chilliest temperature ever recorded at ground level, a record set at Verkhoyansk, Russia, in 1892.

The Boeing plant can hit all these, and more, too. The lab. is adaptable for experimentation with human guinea pigs as well as inanimate ones. Before you will be allowed to take that high-altitude flight in a Fortress, you must first try your ability to "take-it" in strato-chamber. Oxygen equipment must be tried out, too, before it is issued to Fortress crews.

Superchargers Provide H.P.

THE question of maintaining adequate power at high altitudes has long occupied the minds of engine manufacturers throughout the world. In plain language their chief problem has been to overcome the greatly reduced density of the upper air.

Air at high altitudes is "thin" or "light" because the molecules of oxygen are scattered, so to speak, like floating snowflakes, while at sea level the molecules are concentrated and close-packed by the cumulative mass weight of all the air above, like snow packed on the ground.

At sea level the layers of air exert a pressure of 14.7 pounds per square inch. With air at this density, an aircraft engine produces its best power by inhaling about 12 pounds of air to produce complete combustion of one pound of petrol.

However, at altitude, with air at only a fraction of this density, the engine would ordinarily inhale only a portion of the air demanded—with incomplete combustion and a consequent loss of power. It is the job of the supercharger to bring this thin air back to approximately sea level density.

Whirling at speeds up to 26,000 r.p.m.—about 20 times as fast as the airscrew—an aluminium alloy rotor about the size of a dinner plate sucks in air and fuel vapor through the carburettor and imparts to it terrific velocities up to 1250 feet a second—about the speed of sound.

Working like a rotary garden sprinkler in reverse, this rotor, or impeller, slings the vapor off the tips of its blades into curving conduits nested around the circumference of the impeller disc like the outer segment of a big pinwheel. These curving channels of what is known as a diffuser check the velocity of the air on its way to the intake pipes of the cylinders and build up the pressure of the fast-moving air to approximately sea level density.

There are two general ways of supplying the power to turn the impeller. One way is to drive it from crankshaft power, through a train of gears. Ordinary planes, such as passenger transports, which seldom cruise above 12,000 or 14,000 feet, find a single-speed gear-driven supercharger sufficient.

If greater altitude is desired a two-speed supercharger may be used, with a clutch to shift the gears into higher impeller speed as altitude is gained.

The other general way of turning the impeller is to use the energy of exhaust gases to drive a turbine which in turn drives the impeller.

Effects on Pilots

IF the partial pressure of the oxygen in the alveoli is reduced below 3 mm. H9 (normal value at sea level—100mm. H9) grave disturbances of the central nervous system arise. The respiratory centre ceases to function properly and the individual loses consciousness.

The limiting height corresponding to this partial pressure is about 14,000 m. (45,000ft.) or 7500 m. (25,000ft.) respectively, depending on whether the individual breathes pure oxygen or air. It should be noted that these critical altitudes refer to special individuals, less prone to anoxemia than the average pilot.

In the latter case, trouble may be experienced at lower altitudes, 12,900 m. and 4600 m. becoming the respective limits for oxygen and air breathing.

From this it might be deduced that the installation of a pressure cabin is not worth while, except for flights at an altitude in excess of 12,000 m. (40,000ft.) and that pressure in the cabin need only be maintained at the value corresponding to this altitude, provided oxygen is available.

The effects of altitude are, however, not limited to anoxemia, i.e., collapse due to a reduction in the partial pressure of the oxygen.

A rapid reduction in the surrounding air pressure may give rise to severe ear pains, while the liberation of dissolved nitrogen in the blood stream (embolism) may lead to partial paralysis.

Both these factors can be more readily controlled if the pressure cabin is installed and many authorities are of the opinion that such cabins (fully air-conditioned) will become standard practice on civil aircraft operating at great altitudes over considerable distances.

For military aircraft, on the other hand, the pressure cabin is not recommended, since its weight will seriously detract from the performance of the machine, while its extreme vulnerability to gunfire might produce serious results.

Both present and contemplated operational altitude of fighters and bombers are well within the region of oxygen breathing, and an expert recently developed a special nose mask for the purpose which does not obstruct the mouth. Talking, yawning and eating can then be carried out without difficulty. In the case of nausea, vomiting is possible without soiling the mask.

It is enlightening to observe the effects of air pressure changes reproducing the effects of high altitude on the subject in the test chamber.

In a typical test, air pressure was altered after ten minutes to represent some 15,000 feet with a 7 to 10-minute stop at that "altitude," then after two minutes to 18,000ft., and 7 to 10-minute stop and altered further to 22,000ft., with a stop of 8 to 15 minutes; thereafter "descent" to 18,000ft., where a 10-minute stop is made, and further to 15,000ft., with the same stop.

While undergoing this test the future stratosphere pilot is carefully observed—his blood pressure and pulse measured at each "height" and his heart functions supervised. At the same time his reactions, mental behavior, psychological condition, mobility and sensibility are observed.

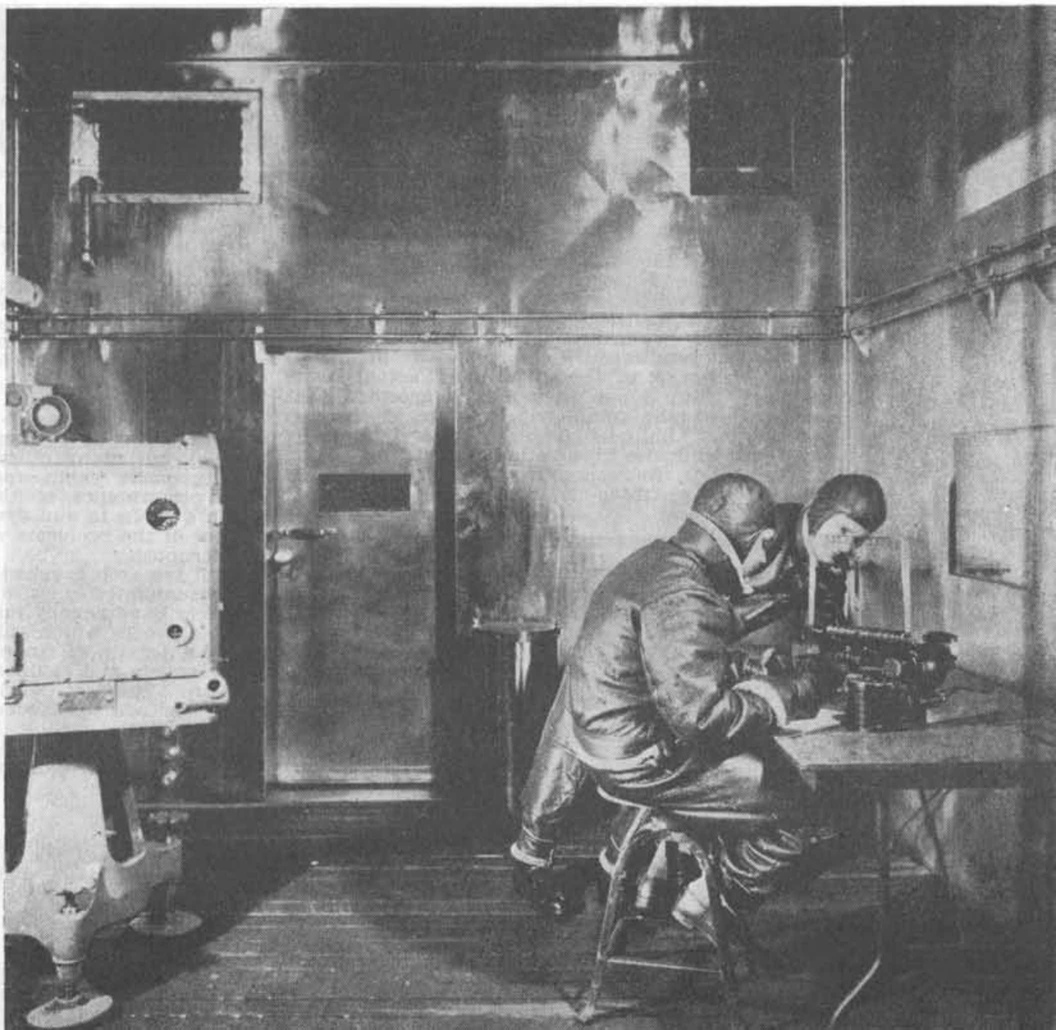
The customary method of noting these reactions is to ask the testee to write his name, figures, and some simple phrase or to make a simple calculation at various "heights."

Let us look at the results of writing tests recently conducted at the Physiological Institute of the University of Zurich. They are typical of tests undertaken in similar circumstances throughout the world.

The Zurich investigations revealed that some 40 per cent. of the testees showed at approximately 20,000ft. "altitude" a temporary trembling and involuntary movement of hands. Several cases showed disturbances of such intensity rendering further writing tests impossible. It was also discovered that there is a definite inclination for involuntary repetition, particularly apparent in writing tests of educated and normally intelligent men subjected to conditions of this altitude.

Of course, in judging the results of such tests, allowance must necessarily be made for the absence of the "responsibility factor," the absence of the danger factor

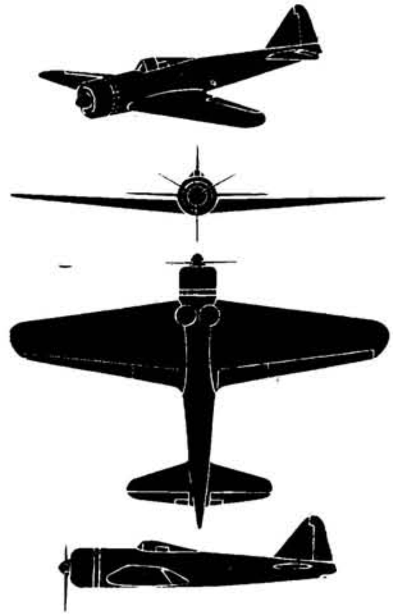
R.A.F. Spitfire pilot with oxygen mask for altitude operations. Britain has been prominent in the development of high altitude fighters.



Cold research room at the Sperry Gyroscope Company's works. Canada has recently ordered additional six rooms such as these, bringing their total to eighteen for altitude testing.

MORE ABOUT . . .

The Mitsubishi Zero



Points of recognition are slight dihedral angle from wing roots, wings straight tapered from roots with more taper on trailing than on leading edge. Triangular shaped single fin and rudder slightly behind tailplane.

THE merits and demerits of the Japanese Mitsubishi Zero (or "00") have been much discussed and like many other aircraft it is either overpraised or underestimated. The reason is that it is a "special purpose" aircraft having been designed for use from aircraft carriers.

Nevertheless this Japanese Navy monoplane is the chief fighter used by the Japanese in this zone of operations.

It is a single seat low winged monoplane of all metal stressed skin construction. It has fitted flaps, transparent perspex-covered cockpit and hydraulically controlled retractable undercarriage.

For carrier work, lightness and quick climbing ability were in the forefront of the designers' minds and the weight, which is 5140 lbs., loaded is considerably less than, for example, the Airacobra, which is 6662 lbs. At the same time the span is greater, being 39 ft. 5 in., compared with the Airacobra's 34 ft.

This gives it advantages in climbing and manoeuvrability which makes it elusive, much as the hare is to the greyhound. But when caught, its lack of armor and lighter armament make it vulnerable to the hard fitting, faster and sturdier Kittyhawks, Airacobras, etc. Moreover, pilots dare not put in a steep dive lest the wings wrench off.

Power is provided by a Nakajima NK-1 14 cylinder two row air cooled radial motor of 1100 h.p. at take off, and 900 h.p. at 15,000 ft. Maximum speed is 315 m.p.h. at 10,000 ft., and normal range 590 miles at 265 m.p.h. Range, however, can be increased to 1600 miles at 160 m.p.h. by the addition of extra fuel tanks slung under the fuselage, making it a particularly useful craft for Pacific long distances. Alternatively a 500 lb. bomb can be fitted.

Service ceiling is 36,000 ft.

The Mitsubishi Zero is said to owe its characteristics to the early Messerschmitt 109. At any rate its armament is now identical with that of the Me 109E — two .303 machine guns firing through the airscrew disc and two 20 mm. shell-firing guns in the wings.

Designation of Zero or 00 comes from the numerals of the Japanese calendar. That is to say, the design was begun in the year 2600 of the Japanese Empire (1940 A.D.), the last two digits being the designation.

It is a mistake to dub all Japanese fighters as Zeros and later types with modifications have been in action north of Australia.

In these greater structural strength has been built in, and engine power and weight increased. Thus while speed and strength have been gained, climb and a manoeuvrability have been lost, and it is doubtful whether the newer types can be launched from aircraft carriers. The later models are said to have points of comparison with the Focke-Wulf 190 and are formidable fighters.

ALTITUDE—Continued

occasioned by the knowledge of the testee that he is actually on the ground and not in control of an aircraft. Such tests reveal that the reactions of the subjects differ from one person to another.

Only by careful co-ordination of psychological and physiological test results can a comprehensive picture of the probable behavior of the pilot under actual high-altitude flying. But it can be generally accepted that the testees are usually completely unaware of the loss or partial loss of his mental capacity, and normally views with great surprise his erratic hand-writing efforts.

In general terms, there are, from the point of view of human resistance, three distinct regions of altitude: Firstly the regions up to 9000ft., where no special aid is necessary; secondly from 9000ft. to some 18,000ft., where oxygen (whether with or without carbon dioxide is a matter of scientific disagreement) must be administered; and finally, the third region, around 30,000ft., where a pressure cabin is desirable.

An oxygen mask may supply sufficient oxygen for operations above this altitude, but the rarified atmosphere does not exert sufficient pressure to force the oxygen into the blood stream.

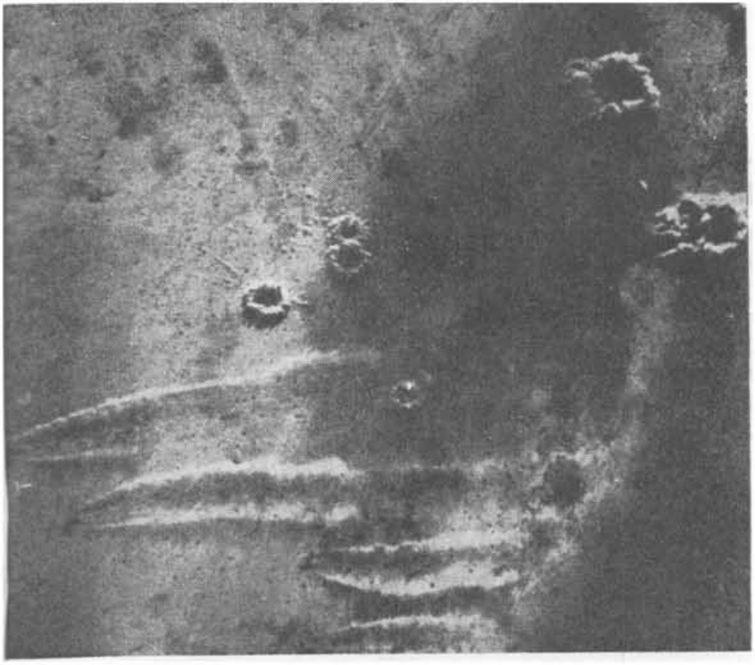
Opinion varies as to the relative advantages of different types of equipment. Many problms have been solved, but many others remain. The extra weight of the pressure cabin and the resulting detraction from the performance of the aircraft, the vulnerability of such a cabin to gun-fire, the heat compensation, are but a few of the problems with which high altitude research is occupied.

But research is relentless and the practical application of accumulated knowledge of the human and engineering aspects have already made possible the advance of flight into altitudes which only a brief time ago were regarded as the domain of record-seeking adventure and kudos.

Scientists and engineers alike are confident that when the full story of World War II. has been told, their high altitude workshops will come in for a big share of the credit for putting that V into Victory.

Meanwhile, the Strato-Labs. are a pretty good place for those who like to do their flying with one foot on the ground!

"It's cold," he says, in spite of elaborate precautions to keep warm in the polar lab., where men have to work under observation through glass windows in case of accidents.



Assisted take off — assisted in this case by bombs from a squadron of Douglas Bostons. Dust trails of four enemy fighters, and what appears to be a landing "T" can be clearly seen. The aerodrome is at Martuba.

AIR VICE-MARSHAL ARTHUR CONINGHAM considers the latest reports at his caravan, headquarters near the Libyan battlefront. Throughout the climatic extremes of Libya he has worked continuously from the most advanced landing grounds.

These German prisoners look as if they don't know when they are well off. They are members of the crew of a Heinkel 111 bomber shot down in combat over the Mediterranean, who were rescued from their rubber dinghy by the British. They then "flew British" in a Bombay troop carried with a "Jock" guard.

AIR WAR IN THE WESTERN DESERT

(British Air Ministry photos).

They had to walk home! They are RAF, RAAF and SAAF pilots, members of the "late arrival club," who walked to their bases after forced landings in the desert. Here they are seen recording their experiences.

Air Chief Marshal Drummond, the West Australian, who has an important command in the RAF, and has played a big part in desert operations. He qualified as a pilot in the Royal Flying Corps in 1916.

EFFECT OF HIGH SPEED DIVE ON AIRCRAFT'S POWER PLANT

Engineering problems encountered and how they were overcome by the Germans in the development of the dive-bomber is told in this article from a German technical magazine, published by permission of the British Ministry of Aircraft Production.

Translated by J. BAKER, from an article in Luftwissen.

THE introduction of German "Stukas" has been one of the great surprises of the present war. By means of this weapon, daring men, with the true fighting spirit, have already obtained innumerable successes of the greatest importance on all fronts. These results could not have been achieved but for the conviction that German scientists and engineers had so perfected the design of this dive-bomber that it could withstand the exceptional demands made on it—especially on the engine and airscrew.

The noise of the high speed dive rending the air with ear-splitting screams is in itself enough to make us realise the terrific strain on the driving gear. This sound is due chiefly to the airscrew on which the speed of the incident air over certain regions exceeds that of sound when the diving speed and engine r.p.m. are increased sufficiently. The effect is favored by the fact that even in horizontal high speed flight, the present highly-loaded airscrews work with their blade-tip speed comparatively close to the velocity of sound.

The crew of the aeroplane hear much less of these noises than the observer on the ground because—especially with high engine r.p.m. a strong directional effect of sound occurs in the direction of the airscrew plane.

Effect On The Driving Gear

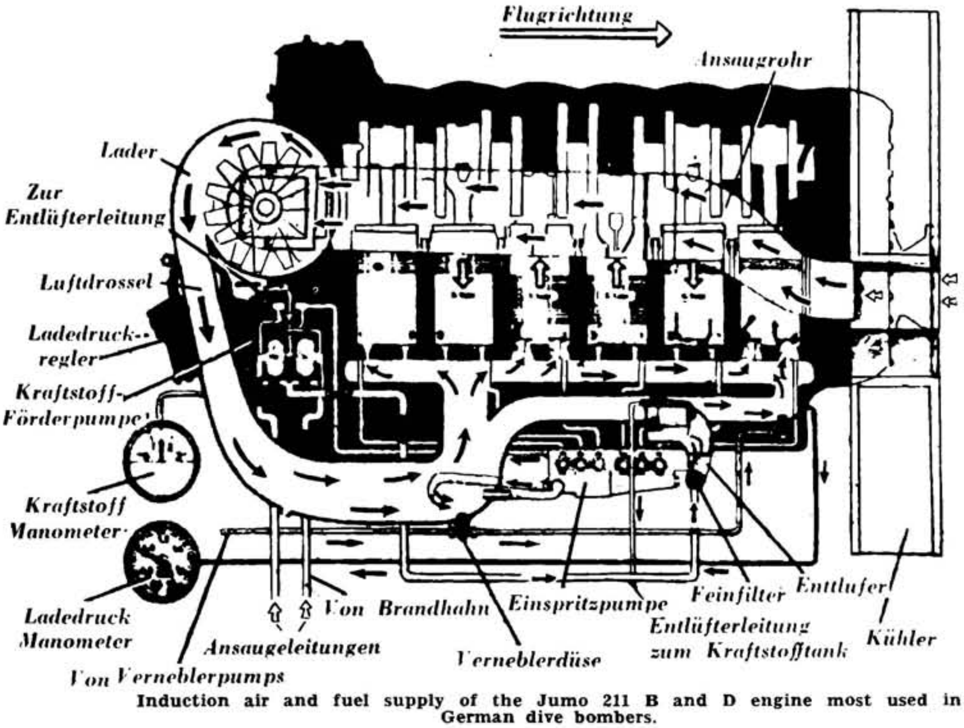
During a dive, both airscrew and power plant are subjected to special effects mainly due to the high speed and consistently steep inclination of the aircraft. Even in stunt flying the power plant is not affected to such an extent nor are the effects as marked. Table I reproduces a brief summary of the most important of these influences and the counter-measures adopted. Further particulars on this subject will be given in connection with the illustrations covering the liquid-cooled 12-cylinder two-bank V engine Jumo 211. All the dive-bombers Ju. 87 and Ju. 88 most commonly used in the Luftwaffe are fitted exclusively with this well-tried high-duty power injection engine.

[The American and British dive-bombers which so far have become known to us are nearly all designed as ship-borne aircraft. Unlike the German dive-bomber, they are fitted without exception with air-cooled engines.]

Engine R.P.M.

Even the first dive-bombers—the "Helldivers," constructed in America at the time when Germany was debarred from any form of military aviation, possessed a comparatively high diving speed although the design of the airframe was still aerodynamically unfavorable. This led to considerable excess r.p.m. in the engines which were fitted with rigid airscrews. As the airframe underwent progressive aerodynamic improvements, the diving speeds and, consequently, the excess r.p.m. speeds in later designs were so greatly increased that in addition to the distressing noises, the great inertia forces gave rise to extremely difficult strength problems for the engine and airscrew. These difficulties also occurred in Hs. 123 fitted with rigid airscrew. This design was the first successful German dive-bomber.

A first attempt was made—(in aircraft in which the diving speed was not high)—to find a remedy in the full-throttle power dive whereby the inertia forces in the engine were, in a great measure, balanced by the gas forces. This resulted in high excess r.p.m. amounting to about 30 per cent. which soon called for a better solution. Since in a high speed dive, the engine with closed throttle, races violently owing to the action of the airflow on the airscrew—(similar to the so-called "windmilling" effect) — and the available resistance torque is very small, an alteration of the blade-setting angle of the airscrew appeared to be the best method of keeping the engine r.p.m. within reasonable limits during a dive. By using adjustable pitch screws and setting the blades to a large pitch, it was then possible



Induction air and fuel supply of the Jumo 211 B and D engine most used in German dive bombers.

Flugrichtung=direction of flight.
Ansaugrohr=suction tube.
Lader=blower.
Zur Entlufterleitung=to vent.
Luftdrossel=air throttle.
Ladedruckregler=boost regulator.
Kraftstoff-Forderpumpe=fuel delivery pump.
Kraftstoff Manometer=Fuel pressure gauge.
Ladedruck Manometer = boost gauge.
Von Verneblerpumps=from atomiser pump (starting).
Ansaugeleitungen=suction pipes.
Von Brandhahn=from main fuel cock in fireproof bulkhead.
Verneblerduse=atomiser nozzle.
Einspritzpumpe=injection pump.
Feinfilter=fine filter.
Entlufterleitung zum Kraftstofftank=vent pipe to fuel tank.
Enttlufer=vent.
Kuhler=radiator.

to avoid exceeding the working r.p.m. ranges even during the most rapid dives.

Thus, by limiting the engine r.p.m. the direct overstressing of the driving-gear was eliminated, but at the cost of a further increase in the diving speed because the braking effect of the engine (depending on a conversion of the kinetic energy of drop of the power plant), had been greatly reduced. Under these conditions, for instance, according to reports of the Curtiss Propeller Division, 1939 — the fantastic terminal velocity of about 925 km./hr. (575 m./h.), was actually reached after a dive of about 900 m. at an engine speed of 2550 r.p.m. with the Curtiss-Hawk 75, a low-wing aircraft with retractable undercarriage, and automatic V.P. airscrew. This record diving speed which is said to have been raised to about 1000 km./hr. in 1940, is not surprising for an aerodynamically excellent airframe of today since the propelling force in a dive is almost equal to the full flying weight, that is to say, about six times greater than the maximum value in the horizontal high speed flight. For purely tactical reasons alone, however, employment of such speeds is useless.

TABLE I.—EFFECTS OF A HIGH-SPEED DIVE ACTING ON THE POWER PLANT

FACTOR.	EFFECT.	COUNTER MEASURE.
High speed in the dive.	a. Airscrew acted on by the relative wind drives the engine (closed throttle) at excess r.p.m. This results in increased stress on engine and airscrew owing to inertia forces.	The use of variable pitch airscrews.
	b. The high relative wind causes super-cooling in the water and oil circuits since the heat given out by the engine is only slight.	Close the radiator shutters.
Closed throttle with high engine r.p.m. during high speed dive.	Great depression in the cylinders and slight combustion, causing oiling-up of the combustion chamber and impairing the ignition.	A combustion chamber of a special design and protected position of the sparking plugs.
Flattening-out at great speed at the smallest possible radius.	Action of a gyroscopic moment on the airscrew, causing additional stress on screw shaft and mounting.	Use of high diving brakes and variable pitch screw to check diving speed and reduced engine r.p.m. depending on the flattening-out radius.
Continuous steep position of aircraft during high speed dive.	The working of the feed and vent pipe of the fuel systems are impaired.	Special arrangement of the suction and vent connections. Use of special automatic vents.
Rapid and large changes of altitude in the high speed dive or climb.	Increased strain on the working of the control apparatus and the durability of their aneroid controls.	Improved materials and method of construction for aneroid controls.

Flattening-Out And Dive Brake

The greater the diving speeds, the greater must be the radius of the flattening-out curve if the centripetal acceleration is to remain below the value 5g which the human body can still withstand for a short time. The minimum altitude for flattening-out becomes so great in the case of high diving speeds, that the accuracy of bomb-aiming is impaired beyond all limits. The important point is, therefore, to limit the diving speed to a value which in all cases, will assure accuracy of aim and safe flattening-out at low altitude.

With this end in view, the Ju. 87 and the Ju. 88, were fitted with diving brakes which, as we know, have already proved indispensable on high performance sailplanes. In the Ju. 87, the brake consists of narrow metal strips placed under the two wings. These strips have a very small resistance when in the position of rest (closed). When spread out, however, they place themselves vertically to the direction of dive. In this position and in spite of their amazingly small surface, they generate in the rapid air flow, a braking effect whereby the greatest diving speed can be reduced by approximately 25 per cent. At the same time a flattening-out device with push-bottom release was installed by means of which the flattening-out operation starts automatically at the instant the bomb is dropped, and is completed at a constant radius, so that the pilot can concentrate all his attention on the target.

By using simultaneously variable pitch airscrews and diving brakes, all necessary adjustments of diving speed and engine r.p.m. can be made in the Ju. 87 and Ju. 88. For this purpose electrically operated variable pitch V.I.M. airscrews with manual control are used, or else Junkers V.S. variable pitch airscrews with automatic governors. In the latter case, the governor carries out the continuous alteration of the airscrew pitch so as to maintain the predetermined engine r.p.m. throughout the whole course of the dive.

Effect Of Cooling Wind

Whereas so far, we have dealt solely with the influences of the diving speed on the strength of the diving gear, we will now give some explanations on the essential influences of the dive on the working behaviour of the engine. We shall deal, in particular, with influences which must be under strict control since the reliable working of the engine depends on them in the most critical phase of the dive, that is to say, shortly after flattening-out, when the engine load is changed from running-light to maximum performance so that the aeroplane can escape from concentrated anti-aircraft fire by an accelerated climb.

The cooling effect of the relative wind reaches its peak during the dive. As, however, owing to the engine running light, the amount of heat to be evacuated is very slight there is a risk of the lubricating oil and engine coolant becoming too cold, thus interfering with the full load working immediately following on to the dive. The regulator flaps of the coolers must, therefore, be closed and hermetically sealed before starting the dive.

Effect Of The Closed Throttle

The essential condition that the throttle must be closed during a high speed dive results in a comparatively high suction pressure in the cylinder of the engine turning at a high r.p.m. The motor will vary directly as the diving velocity and a considerable quantity of oil is sucked from the piston bearing surface into the combustion chamber. As the combustion is practically negligible, this oil collects and escapes through the exhaust pipes. This phenomenon as such is not to be considered as dangerous to the engine during a dive. At the same time greater demands must however be made on the sparking plugs which in spite of oiling up during the dive, must on no account cause miss-fires when changing over to the subsequent full-load climb. This danger can be avoided by a suitable shape of the combustion chamber with specially protected positions of the sparking plugs.

The illustration gives a very clear idea of the path of the induction air in the Jumo 211. The air passes the inlet in the dynamic scoop through the suction pipe and a system of guide-vanes into the centrifugal supercharger where both its pressure and speed are increased. The air then passes through the throttle (which is under automatic boost control), and enters an expanding diffusor in which a part of the kinetic energy is converted into pressure. Induction pipes lead from the diffusor to each cylinder bank. It will be noted that these leads are further sub-divided to ensure a uniform distribution of the air charge to the individual cylinders.

Influence Of Position

A high-speed dive at an angle of 70 deg. to 80 deg. from a great height terminating after several stages within a few hundred metres of the target, frequently takes 30 sec. The position, with almost vertical longitudinal axis which the engine must occupy during the dive is therefore comparatively more pronounced than in acrobatic manoeuvres in which the effect is, generally speaking, of much shorter duration and also considerably weakened by the centrifugal forces. Above all the performance of the fuel installation is affected. It is absolutely essential for the performance of the plant that the suction and ventilation leads should be connected with the storage tank in such a way that the supply is always assured not only in the high-speed dive, but especially in the subsequent climb,

and that in all positions, one ventilation lead is always clear. Other counter measures will now be explained individually.

Fuel Supply

Thorough ventilation is of special importance in ensuring an uninterrupted supply of fuel. The diagram of the fuel path shows how this condition is obtained in the Jumo 211. Starting from the main cock in the fireproof bulkhead, two suction leads run to the duplex fuel delivery pump and from this point a common pressure lead runs via a fine filter and a float controlled deaereator (vent) to the injection fuel pump. A lead connects the float controlled vent directly to the fuel tank. The vent of the fuel delivery pump is also connected to this lead. Close by is the connection of the atomiser pump which sprays atomised fuel through nozzles into the induction lead at two points so as to simplify starting.

Lubricating Oil System

The lubricating oil system is most seriously affected by the position of the aircraft. The storage tank is connected by a suction lead with the pressure pump which delivers the lubricating oil to the lubricating points via a slot (streamline) filter (grey lines). The return lubricant (black lines) collects, in front, in a gear box sump and, at the rear, in the auxiliary drive sump. From each of these two reservoirs (which also drain the return from the crankcase sump), the lubricant is evacuated by means of a suction pump to the radiator and finally returned to the storage tank.

During the high speed dive the return lubricating oil collects chiefly in the front sump and, during the climb, in the rear sump. The two suction pumps must, therefore, be designed so that they can safely carry the quantity of lubricant distributed in this way. During a dive the pump occupying the topmost position, however, delivers almost entirely pure air which reaches the storage tank from which the greater part is exhausted through the tank vent (directly into the crankcase).

Care must be taken, however, to prevent any air bubbles which may still be in the lubricating oil from penetrating into the crankshaft bearing, as experience has proved that bearing surfaces which have become heated during operation, are liable to be seriously damaged by corrosion. For this reason, a special vent is installed in front of the lubricant inlet on the shaft. The vent operates on a centrifugal principle, the heavy lubricating oil being forced outwards into an expanding ring chamber from which it passes to the bearing while the lighter air bubbles collect about the axis of rotation and pass into the crankcase.

Questions Concerning Operation

The dive-bomber pilot is, of course, expected to possess the highest qualifications, flying efficiency as well as a capacity for reacting rapidly in all circumstances. In addition to attending to his aeroplane and its armament, he must carry out the following operations, before starting the dive:—

—closing oil and water radiator,
—setting airscrew for large pitch,
—closing throttle of engine,
—putting on high speed dive brakes,
—adjusting the trim of the aircraft.

Immediately after flattening-out, i.e., during a critical stage of the attack and whilst still under the influence of the physiological after-effects of flattening-out, he must

—close the high speed dive brakes,
—alter the trim,
—re-open the radiator,
—set the airscrew for small pitch for climb, and
—open the throttle steadily until full load is reached.

Thus it is very evident that the pilot's attention will be fully taken up by the special control of the power plant. Future developments should, therefore, be directed primarily to simplifying the service and eliminating all sources of error by an extensive use of automatic controls.

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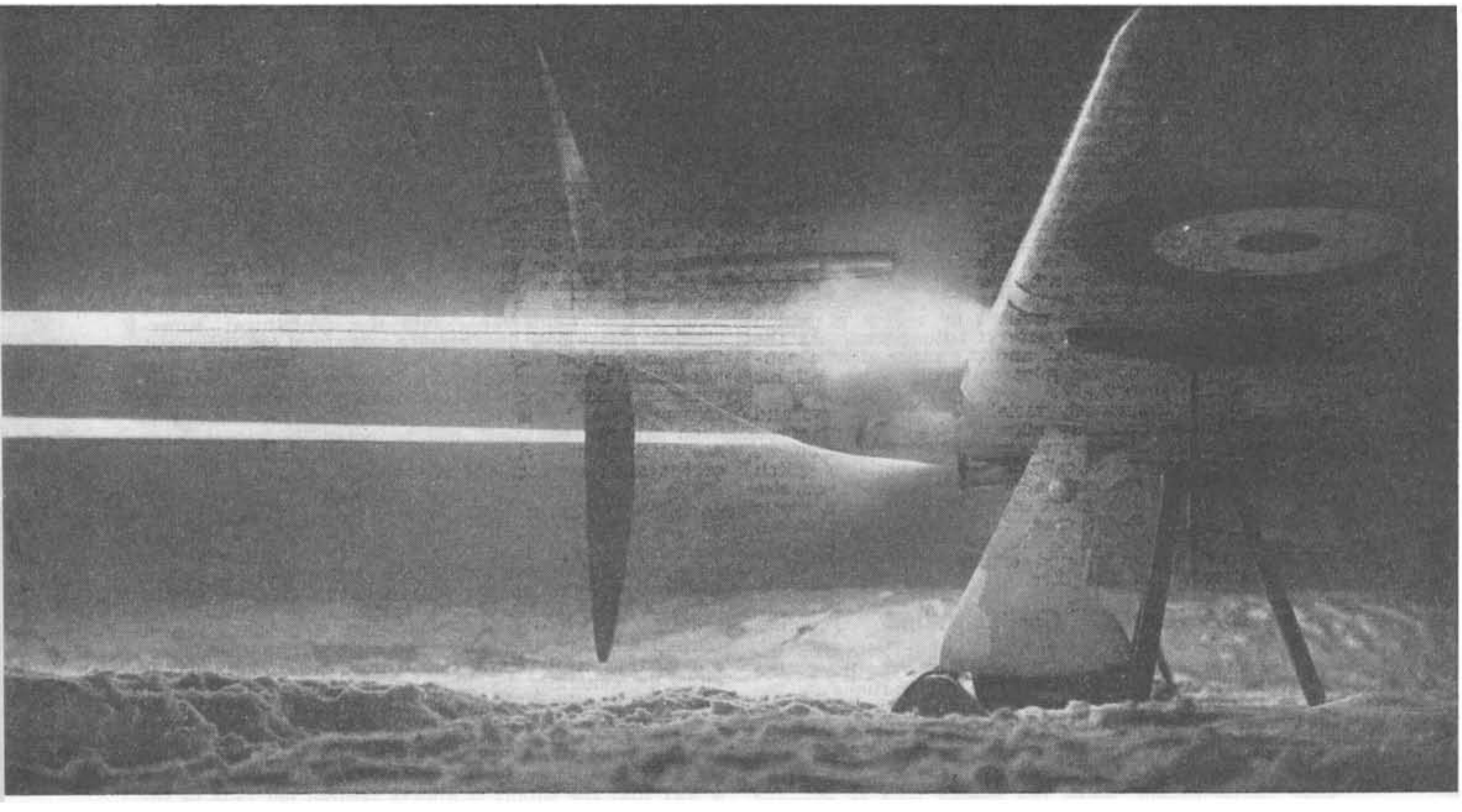


Remarkable sight of a burst of fire from a Hurricane of the R.A.F. fighter command. One tracer bullet in four was introduced to give the luminous effect and the picture records a burst of 1600 rounds in all.

Personalities In Aviation:

Captain Ivan Holyman

IVAN HOLYMAN, aged 17, wanted to go to sea. Naturally enough, since his father was a sea captain, his father's two brothers, and their father before them and, in Ivan Holyman's own generation, two of his brothers.

Sizeable chapters in the history of Australian avation owe their existence to the persuasive powers of Captain William Holyman, who induced son Ivan that he should, instead, enter the Launceston office of William Holyman and Sons.

But on August 12, 1914, with two years to which he had no title showing on his papers, the young man from the shipping office was in the army where, for four days, he remained a private.

In the landing at Gallipoli young Holyman was wounded, taken off, and brought back to get his commission on the Peninsula, where he stayed until enteric got him after Lone Pine. Then France, two mentions in despatches, the Military Cross, and celebrations of his twentieth birthday some time after his promotion to captain had come through.

That record showed that the young man had, as they say, what it takes. His own opinion was that he had what it took to go on the land. Certainly, his father agreed, if he had made up his mind, he should be a farmer. But the firm was in a jam for men at the moment, so surely he'd help out for a few months as branch manager at Devonport, Tas.

Ivan Holyman grins. "I still think I was outmanoeuvred," he says.

At 24, when his father died, he went to Launceston and was associated with his uncle in the management of the firm. There, for some years, he stayed, building up a shipping business.

His brother, Victor, master of one of the firm's ships, had done his wartime service in the Royal Naval Air Service, and when he stood on the bridge he was generally looking at the sky and thinking that the air was the better element. By 1932 he had convinced Ivan that there was something to aviation, and Tasmanian Aerial Services was founded, to fly from Launceston to Flinders Island. The new company's aeroplane was that redoubtable old taxi, the Fox Moth. The pilot was Victor Holyman.

One aeroplane obviously wasn't enough. The firm expanded, taking in Captain L. McK. Johnson with his Desoutter. And in September, 1933, when the first multi-engined aeroplane—a D.H. Dragon—arrived, the company began its service to Melbourne.

Early in 1934 the firm, now Holyman's Airways Pty. Ltd., tendered for the Bass Strait air mail service, offering the Commonwealth class lines, then just developed. On October 1, the first trip was flown. And then Fate picked the young airline company up and flung it on the floor and jumped on it with both feet. Within three weeks, the first four-engined aeroplane was gone, and with it Victor Holyman. A year later, a second went. Hard on that came a forced landing on a Bass Strait island which still further shook the faith of Australians in aviation.

Ivan Holyman could tell you of one night when, crossing Bass Strait, he paced the deck of the ship most of the night. He was deciding whether to get out of aviation, or stay in. "Don't be a damn fool. Get out!" His friends had told him.

"I'll stay in," he decided.

He was sure of one thing. He was going to have the best aeroplanes that flew. So he ordered the first Douglas DC2 ever brought to Australia — Bungana, which arrived in April, 1936, and is still flying.

It is pretty generally agreed that people in aviation do some extraordinarily silly things. That much was admitted even in 1936. But in 1936 it was agreed in aviation, almost without a dissentient voice, that of all the silly things that were ever done, Ivan Holyman had done the silliest. Douglas DC2s were handsome aeroplanes. They were faster and more comfortable and safer than anything this country had seen before. But the idea of trying to operate them here was just plain stupid. Holyman was riding for a fall.

So they said. Today, of course, they wouldn't fly in anything but Douglasses, or something pretty much like Douglases.

It is doubtful if Ivan Holyman ever knew how much knowledge and experience and common sense were lined up in condemnation of his folly. It's quite certain that if he had known, he would not have cared. When he makes up his mind, it stays made up. He had decided to go on with aviation, to make it a much bigger thing in Australia than it was, to give Australia the best there was in the way of airline equipment. If other people thought he was wrong—well, they were entitled to their opinions.

Aviation had to be big. So he brought together the Adelaide Steamship Company, the Orient Line, the Union Steam Ship Company, Huddart Parkers, and Holyman Brothers, to buy out Holyman's Airways and Adelaide Airways, a subsidiary of Adelaide Steam, which was running Rapides between Melbourne and Adelaide. In November, 1936, the new company was formed, although its operations are always dated back to July 1 of that year. Purchase of West Australian Airways, the country's oldest line, took the route across the desert to Perth; virtual absorption of Airlines of Australia took its influence up into Cape York.

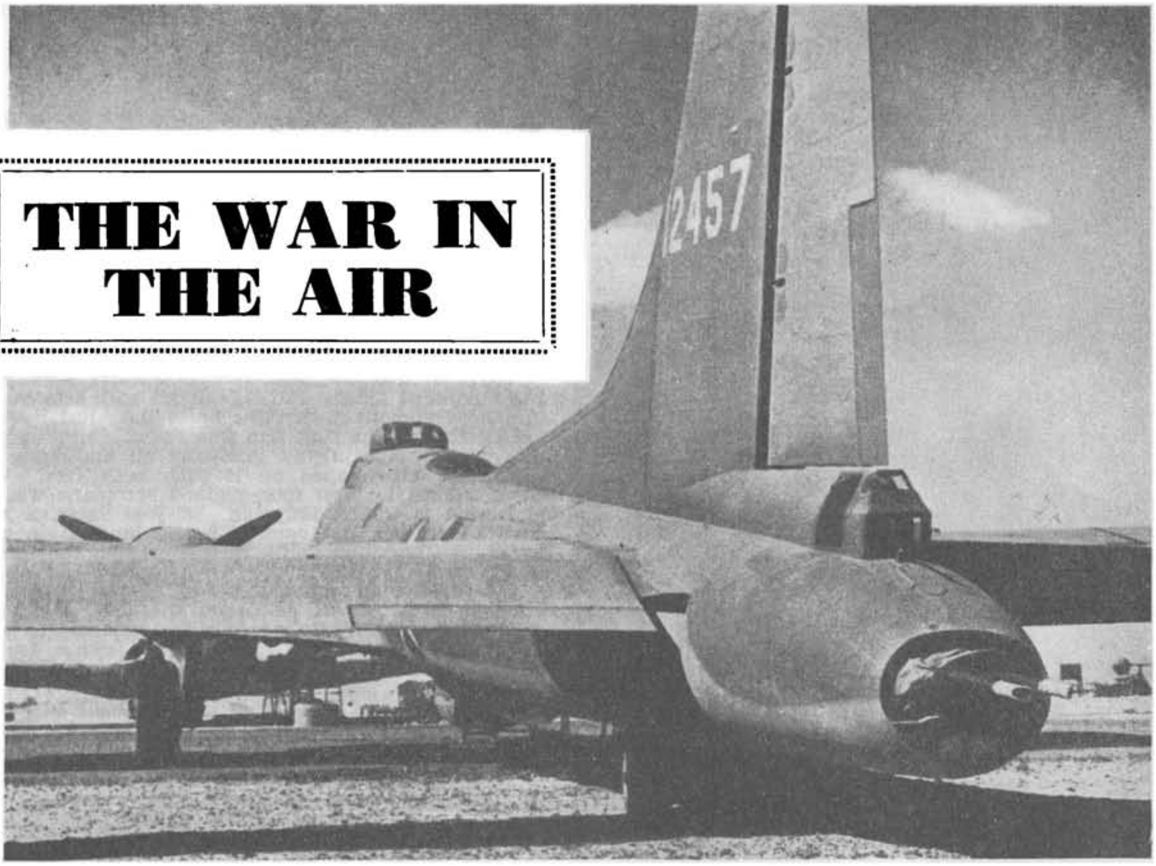
Since then aviation in Australia has become what it is today, with Australian National Airways forming the pattern of growth. The company's own progress can best be told in figures. Look at this comparison (Airlines of Australia figures included for last year):—

	1936-37	1941-42
Hours flown	14,244	34,395
Miles flown	1,756,000	4,682,283
Passengers	18,400	105,362
Passenger-miles	8,750,000	44,748,441
Freight (lbs.)	212,000	1,584,887
Mail (lb.)	—	937,112

Those last year's figures do not include nearly 3000 hours of flying for the Allied forces, doing essential war work—work that could not have been done had the aeroplanes and the organisation behind the aeroplanes been available.

They do not even hint at the great volume of war work other than flying that the company has done. They give no clue to the immense national value of one of the finest instrument shops in the world, which the company had ready to keep the warplanes in the air.

(Continued on Page 20)



THE WAR IN THE AIR

New angle on the Fortress, showing the sting in its tail. Fortresses have recently engaged in the first all-American raids in Europe.

Aircraft's Monthly Review of the air fighting on all fronts.

WHAT Britain and the United States are planning to win the war is an invasion of Western Europe. When, is a secret —except that in the agreement with Russia, 1942 is stipulated. Where is also a secret, except that if British fighters are to give support it must be along a stretch of coast between Holland, Cherbourg, or, perhaps, at a pinch, Brest.

Just how necessary that support will be, and how effective, was shown on August 19, at Dieppe. Possibly by the time this is read it will have been demonstrated again. Every story of that Dieppe raid, the biggest combined operation the United Nations have attempted in Europe, emphasises just how important the air side of it was, and how superbly Britain's truly independent air force did the task.

Air operations were not on the scale envisaged for an invasion. There was no preliminary merciless pounding of all communications centres in the near-rear of the German defence forces to shatter their mobility. Presumably this was foregone in favor of surprise, but the accident by which the small invasion fleet was sighted when well offshore killed the surprise, lost that advantage, and the Nazis were able to whistle up aeroplanes from all over Western Europe, and, presumably, troops from within a considerable radius.

The immediate result was the fiercest air fighting since the Battle of Britain. Probably more aeroplanes were engaged than ever fought then, for the German aeroplanes were of more formidable types — mainly FW190's, from all accounts—and Britain was not, this time, short of fighters.

Our losses—98 aeroplanes, with about a quarter of the pilots saved—were considerable, but well worth while if, as is estimated, we destroyed one-third of the German air fleet stationed in Western Europe. The Dieppe raid would certainly force the Germans to build their western force to a greater size than before, a result they could probably achieve only by withdrawing squadrons from the Eastern Front, since it is clear that they are not at present holding much in reserve.

Next day, when 500 fighters went over in a sweep, they could hardly bait a Luftwaffe machine into the sky.

Most interesting conclusions come from a comparison of our losses with the Germans'. We claimed 91, with another 180 or so probable. If we take it that half the probables were lost, and in view of the conservatism of British methods of estimating enemy losses, that is not being over-optimistic, we find that the Spitfire comes out of a mass clash considerably better than the FW190 which opposed it.

From recent hints about the effectiveness of the FW 190, one would hardly have expected the result to be as favorable as this when we were doing the attacking, necessarily exposing to the hazards of day bombing in a restricted area a considerable number of bombers, and when the Germans, too, had the advantage of using the same radio-location which served us so well in the Battle of Britain.

Many lessons of the raid will be filed away in Air Ministry archives and impressed on the minds of RAF personnel, but will not be disclosed to the public. Among them are effectiveness of different types of machines for army support in operations of this kind —cannon-firing fighters, fighter-bombers and attack bombers in particular. The expanded Army Co-operation Command was on the job with the fighters it has been allotted, including the Mustang, presumably chosen for this job because its Allison is not boosted for the higher levels.

Biggest Lesson of Dieppe

But the biggest lesson is plain for anyone to see. It is that we can inflict on the Luftwaffe in Western Europe losses so severe that they cannot be replaced without taking aeroplanes from other fronts—and the Nazis have aeroplanes on other fronts only because they are needed there, not for show.

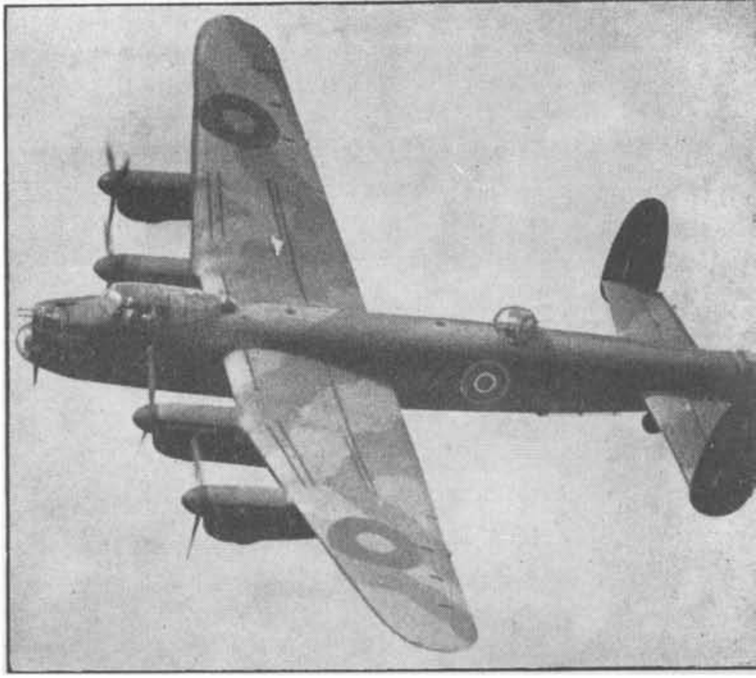
It is a fair assumption that the 3000 sorties over Dieppe in the day did not represent the maximum that the RAF could carry out. Many of those sorties were certainly carried out by bombers, and some, perhaps many, represent two or three sorties by one aeroplane. Nor is it likely that lack of aerodromes was a limiting factor.

On this basis it appears that the RAF could support two or more similar raids simultaneously, such as would be made if a Continental invasion were contemplated. Attacks on other fronts, even if only nuisance raids on Sicily and Italy, the Dodecanese and Norway, would be a deterrent against stripping these fronts too ruthlessly to make up for Luftwaffe losses in the West.

Britain's fighter production has for so long been very large, and losses low, that, despite shipments to Russia, the Middle East and other fronts, reserves must be adequate to sustain the Dieppe rate of loss for a reasonable period—longer, at any rate, than Germany could.

With the prospect of the Germans gaining in Russia such advantageous positions that they could remove most of the Luftwaffe for the winter and resume large-scale bombing of an England where there are many more military targets than existed in 1940, British and American military leaders must be making the most of all these military factors. It would not be in the slightest degree surprising if they had already decided that, on balance, the best chance to win the war would be by an invasion of Europe in September.

If that decision has been taken, we shall soon see the signs of it. Sweeps will be intensified, and there will be regular and heavy raids on transport centres and junctions in Occupied France. It almost seems that the first shot was fired—and perhaps it did have something to do with Dieppe—when Flying Fortresses of the American Army Air Force went over twice in daylight.



First photo to be released of the Avro Lancaster which takes its place with the Stirling as the world's biggest and most powerful bomber. Details are: Loaded weight, 30 tons; Speed, about 300 m.p.h.; 4 Merlin XX engines, each with 1260 h.p.; 8 guns in dorsal, tail and belly turrets; 8 tons of bombs; length 69ft. 4in.; span, 102ft.

Fortresses In Europe

About this time a brisk controversy flared up; one long familiar to everyone in aviation, but pretty new to the general public. Many Britons and a few Americans were saying that America's biggest bombers were not suitable for bombing Germany, many Americans and a few Britons were defending them.

There is no doubt, of course, that for carrying heavy loads to be dropped at night, in such operations as the 1000-bomber raids, neither the B17 nor B24 is in the same paddock as the Stirling and the Lancaster. And both these British aeroplanes have shown that they are capable of looking after themselves fairly well in the daytime.

But a notable fact about the recent sallies of the 17's over France is that not a machine was lost, and on one occasion they were unescorted.

For this there are two reasons: the fact that the Fortress operates at a much greater height than any of the British bombers, and in a region where the attacking fighters have begun to fall off in performance. And, second, the heavy defensive armament fitted to the latest of these American aeroplanes.

The American bomb-sight, to judge by results against Japanese ships in the Pacific theatre, is very accurate, even from great heights, and two tons of bombs well-placed by day may be worth much more than eight tons dropped, perhaps in the middle of a park, at night. Unfortunately, this does not take into account the sort of weather that prevails over most of Europe most of the time. In the European haze, even the most definite target, easily recognisable from photographs, can be completely masked from the bomb-aimer 30,000 ft. above. This seems to be the limiting factor in the employment of American bombers for the task which suits them best.

The same factor operates to a much smaller extent in the Pacific. This makes it seem that the Fortresses and Liberators might well be supplied in greater quantities to Australia, India, and—if fuel and bombs can be got in—to China.

What numbers of these aeroplanes have been engaged in the Battle of the Solomons we do not yet know. In fact, we know precious little about this battle at all, the first outside Russia which has been fought, on the Allied side, behind an almost complete screen of censorship. But at least in the resistance to the Japanese counter-attack land-based bombers as well as carrier-borne machines have been heavily engaged against Japanese shipping, with a considerable measure of success. It is also not stated where these bombers have been based, but anyone with a map can make as good a guess as the next person.

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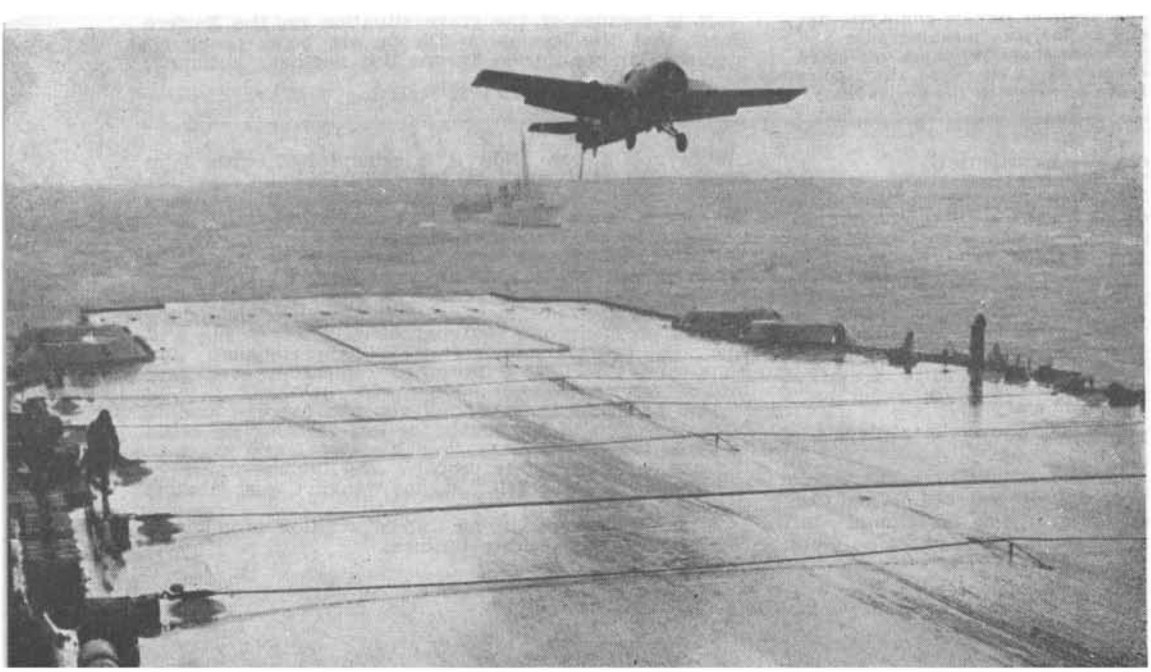


Martlet landing on the deck of British aircraft carrier Illustrious. This is the Navy's fastest fighter with top speed of 325 m.p.h. Power is one Wright Cyclone 1200 radial and armament 4 machine guns in the wings.

PE-2, Russian light bomber which carries a crew of three or four, and has a large area of glass under the nose. Bomb load is about 1700lbs., and top speed believed to be just over 300 m.p.h.

Russian fighter of the Rata, or I.16 series. In appearance they are similar with the Brewster Buffalo and I.16C, has 1000 h.p. twin row radial engine, two machine guns and 2 cannon in wings. Top speed about 300 m.p.h. combined with exceptional manoeuvrability. A later type, I.26, similar to the Hurricane, is also in service with the Soviet Army.

Although only once, in an attack on enemy ships at Faisi, in the northern Solomons, were bombers from Australia directly engaged in the Solomons battle, Allied forces here had an important job in keeping Japanese air forces pinned down. In the early stages of the battle particularly, both air crews and ground crews had little rest as they kept the bombers shuttling backwards and forwards between Australian bases and the Japanese aerodromes in New Guinea.

Because of the importance of Rabaul as a sort of junction for the Japanese air forces, the tasks carried out from Australia undoubtedly played an important part in the original Solomons Battle, and as this is written the sudden flare-up of activity indicates that we are repeating the dose.

Perhaps the most significant single action of the war near Australia was the Japanese raid on the Darwin area on August 23, when Allied fighters shot down four bombers and nine Zeros without themselves losing an aeroplane.

Importance of Australian Bases

Reports of this clash, officially and justifiably called a brilliant interception, showed that the fighting began at considerably more than 20,000ft., and that up there the Kittyhawks had the edge on the Zeros. The Japanese pilots were probably not much more surprised than a good many Australians who read this, but they were much more gravely inconvenienced. Neither Japanese nor the Australian public yet knows how it was done—but the Australian public appreciates it.

When that was followed by destruction of 31 pilots on the ground in the New Guinea area, for the loss of one of ours, local news looked much brighter.

Incidentally, not long before it was officially stated that in six months' raiding of Darwin, the Japanese had lost 20 bombers and 33 fighters, with another 12 bombers probably, that we had lost only 17 Kittyhawks, and that on our bombing raids we had lost only six bombers and shot down at least 19 Japanese fighters. It seems that if we could put more aeroplanes into the north we could keep the Japanese factories busy.

Still the gravest news of the war comes from the Russian front, where the battle for Stalingrad, perhaps the most colossal military push ever made, is now at its peak, with the fall of the city apparently imminent unless the Russians can repeat last year's miracle of Moscow. Both here and in the Caucasus, where the Nazis are pushing steadily on towards the Grozny oilfields, they are said to have great superiority in the air—superiority that is costing the Russians dearly in lives, and all the United Nations in hopes of relatively early victory. The Russians apparently still have some big bombers in reserve, for they have opened up their own second front with raids on Warsaw and East Prussia.

It is because of the grave situation on the Eastern Front that the lessons on Dieppe are being so closely studied. Can we invade Europe this northern autumn?

CAPTAIN HOLYMAN—Continued

What the assorted totals of those figures add up to is a revolution in Australian transport and communications, a revolution that did not begin until Ivan Holyman decided to buy a Douglas DC2. The growth of the company's operations forced an equal growth, which has been of immense value since war broke out, in governmental ground organisation of all kinds. It brought in its train a string of manufacturers and workshops making things and doing jobs for the airlines as soon as they were big enough to be a market, which have again been of very definite value as a defence asset.

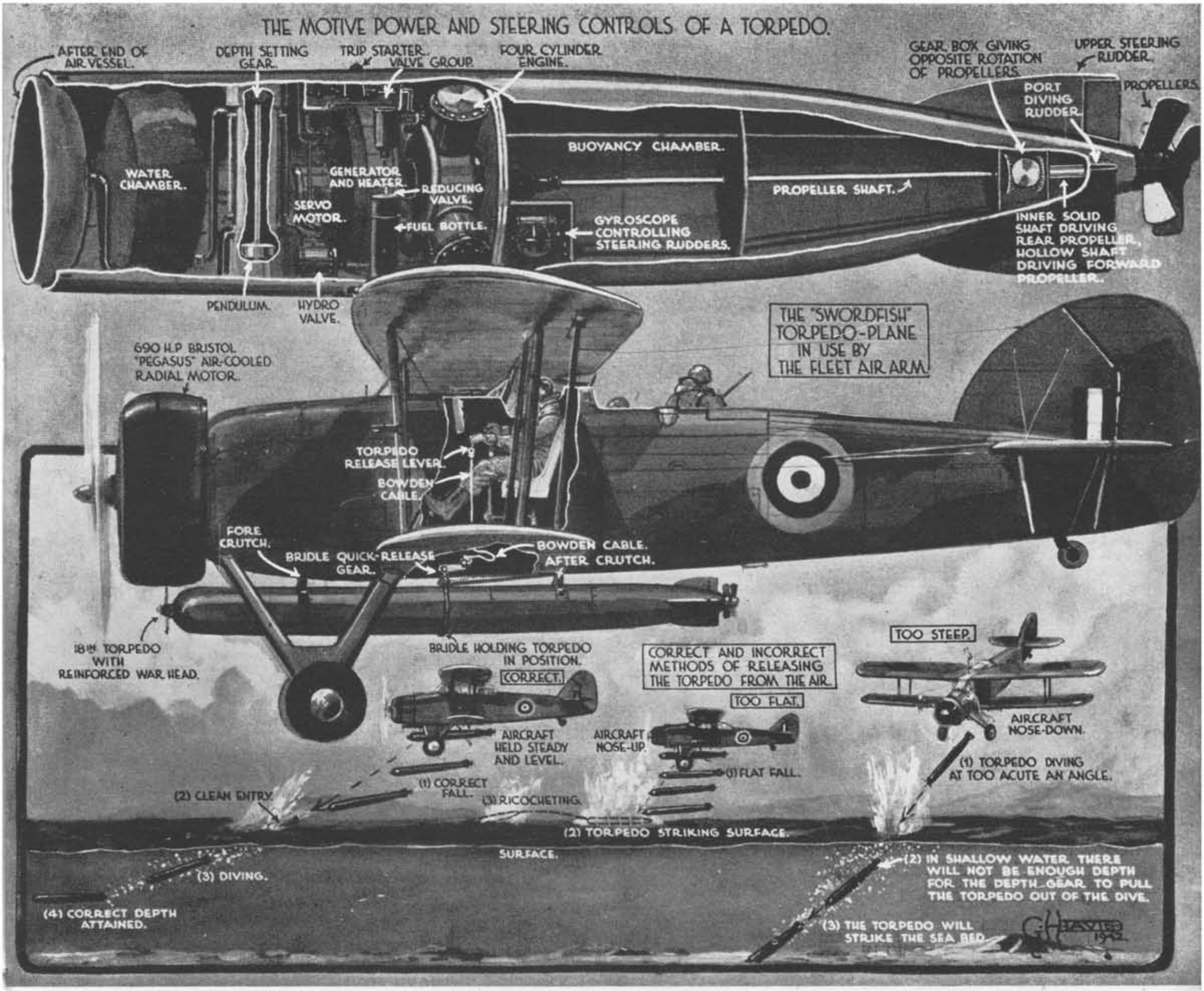
Ivan Holyman is immensely proud of the change represented by those two tables, but he doesn't take all the credit he might be given for it. There has been a lot of other people in it, too, he points out. When Tasmanian Aerial Services began flying its ground staff was one man and one boy—more specifically, John Stubbs and a boy. Now it is around 1800, with John Stubbs still very much in the picture.

But those who have watched closely as the company has grown know what has pushed it along—the compelling drive of Ivan Holyman.

Drive? People say he is a driver. So he is, and he drives himself harder than anyone else, and thrives on it. He does not look his 46 years. He looks as confident as he is. He does not look as if the posts of managing director of Australian National Airways and Airlines of Australia, general manager of William Holyman and Sons, and director of 14 other companies ever gave him a worried moment.

But he could probably tell you the average loading on any section of his routes for last month. He could tell you, too, the average time his aeroplanes spend in the air daily, which is probably the highest figure in the world; he could tell you, but wouldn't, just what is the secret of this.

When the war ends, he thinks, aviation is going to develop into quite a big business.



Torpedo Mechanism And Method

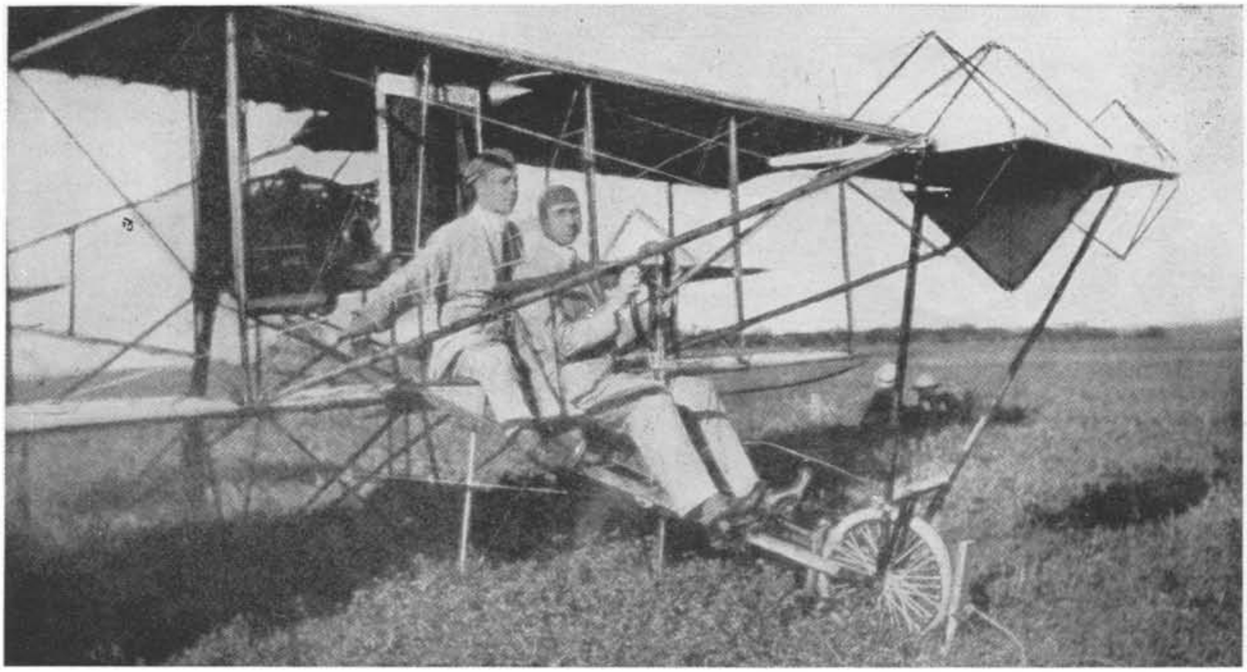
AS in the last war, so today the modern torpedo has proved itself far more deadly than the gun, the mine, or the aircraft bomb in naval warfare. The chief difference in this war is its added power owing to its use from aircraft. Apart from the question of the power of a single torpedo to sink the largest of merchant ships, not even the largest and latest type of capital ship can survive a series of hits from torpedoes. In this war the Allies have lost a number of great fighting-ships to the aeroplane because of this weapon, including, of course, Britain's latest battleship, the ill-fated "Prince of Wales."

Bulges have been tried, triple hulls, ships honeycombed ith transverse and longitudinal bulkheads, but still the "tin fish" are triumphant.

In the front of the long cylindrical hull of a modern torpedo is packed the great hitting force of 700lbs. of explosive with the detonator and other gear for causing explosion on contact, and in some cases after outer penetration. Behind this is the air chamber, containing compressed air at a pressure of 2500lbs. to the square inch, and aft of this is the "engine room," packed with intricate machinery for propelling the weapon, keeping it true to its course at the correct set depth, and at the rear end the propellers revolving in opposite directions to avoid "torque," or the rotating of the torpedo if a propeller moving in one direction only were used. The motivating machinery is illustrated above.

Fuel and air are burnt in the generator and turn water from the water-chamber into steam. The steam and products of combustion thus formed pass to the little four-cylinder radial engine, and so provide the motive power. This is conveyed by means of a solid shaft to the rear propeller passing through the gear-wheels of the gear-box. The rear gear-wheel has attached to it the hollow shaft driving the forward propeller and by means of the idler wheels the two propellers are made to rotate clockwise and anti-clockwise. A pendulum connected to intricate gear governs the depth, which can be set before the torpedo is fired. A small and mechanical marvel—the gyroscope—operates the steering rudders and keeps the torpedo on its course.

In this war increasing use is being made of the torpedo 'plane carrying an 18in. torpedo, although some think the size of the aerial torpedo should be increased to 21in. to equal the ship's weapon. The cost of a torpedo is anywhere between £8000 and £10,000, and its little engine develops well over 350 h.p., giving the weapon a speed of over 45 knots for the first 2000 yards of its run.



Thirty-one years ago Joe E. Brown went for a flight with his friend Glenn L. Martin in this airplane, product of the hand and head of the man who now operates one of the world's most famous aircraft manufacturing plants, the Glenn L. Martin Company, Baltimore, Maryland. In 1911 Young Martin barnstormed in a craft of his own design and manufacture. He poured back into his small aircraft factory all his prize money collected. Brown was an acrobat and Martin inveigled Brown into an airplane flight. Joe's expression indicates that this might have been the first time he thought of yelling h-e-e-L-L-P!

Glenn Martin Co. photo.

DIGEST OF WORLD AIR NEWS

500,000 lb. Flying Boats?

WE are heading for winged vessels larger than any we have yet dreamt of. Transoceanic air operations, now being conducted so successfully by our American companies, are presently based on aircraft having a maximum gross weight of between 82,000 and 84,000 pounds. These flying boats can carry a payload of about 4000 pounds a distance of between 3000 and 4000 miles, depending on head-winds and the amount of fuel reserve needed. Such performance, lest it be thought little of, is an outstanding technical achievement which was considered impossible a very few years ago. Passenger accommodations in these airplanes are excellent.

But these aircraft are inconsiderable indeed compared with the flying ships we are already planning. I can tell you that my company already has plans for a 250,000 lb. commercial air vessel. And I can tell you also that our studies have, as a matter of fact, shown that no technical considerations limit the size of airplanes that can be built, the only limit is the amount of payload available per trip. Indeed, we should be able to build 500,000 lb. airplanes in a very few years.

We would not project our 250,000 boat unless we knew that engines and propellers and advances in aerodynamic and hydrodynamic design were available to make such a ship technically feasible. Nor would we project it if we had any doubt that it is also economically feasible. The determining factor is the availability of payload. Of that traffic in the post war world I am confident.

Over the New York-London route prevailing winds are eastward, averaging around 20 miles an hour at low altitudes. In the carrying of passengers, it is sound commercial practice to provide sufficient fuel for the headwinds forecast for a given flight, plus four hours of reserve fuel. Then let's take the London-to-New York span, against the wind. We would need fuel for 4700 miles in still air in order that 3500 ground miles will be covered, with four hours of fuel remaining at the end of the flight.

Under the conditions assumed, the 250,000 lb. airplane will carry a payload of 50,000 lb. — equivalent to 100 passengers with 80 lb. of baggage apiece, plus 25,000 lb. of mail, cargo and express. This flight would be made at sea-level in order to avoid the higher head winds at higher altitudes, at a cruising speed of 200 miles an hour.

On the eastbound trip, the flight would be made at about 10,000 feet, taking advantage of the tail wind of between 30 and 40 miles an hour. The saving in fuel would enable the ship to carry 60,000 lb. of payload at a cruising speed of 230 miles an hour.

The elapsed time eastbound would be about 13 hours, and the elapsed time westbound around 19 hours. Thus, we see, it would be possible to ride from New York to London quicker than we can ride by train from New York to Chicago.

—*Glenn L. Martin, President of the Glenn Martin Company, in Air Services, U.S.*

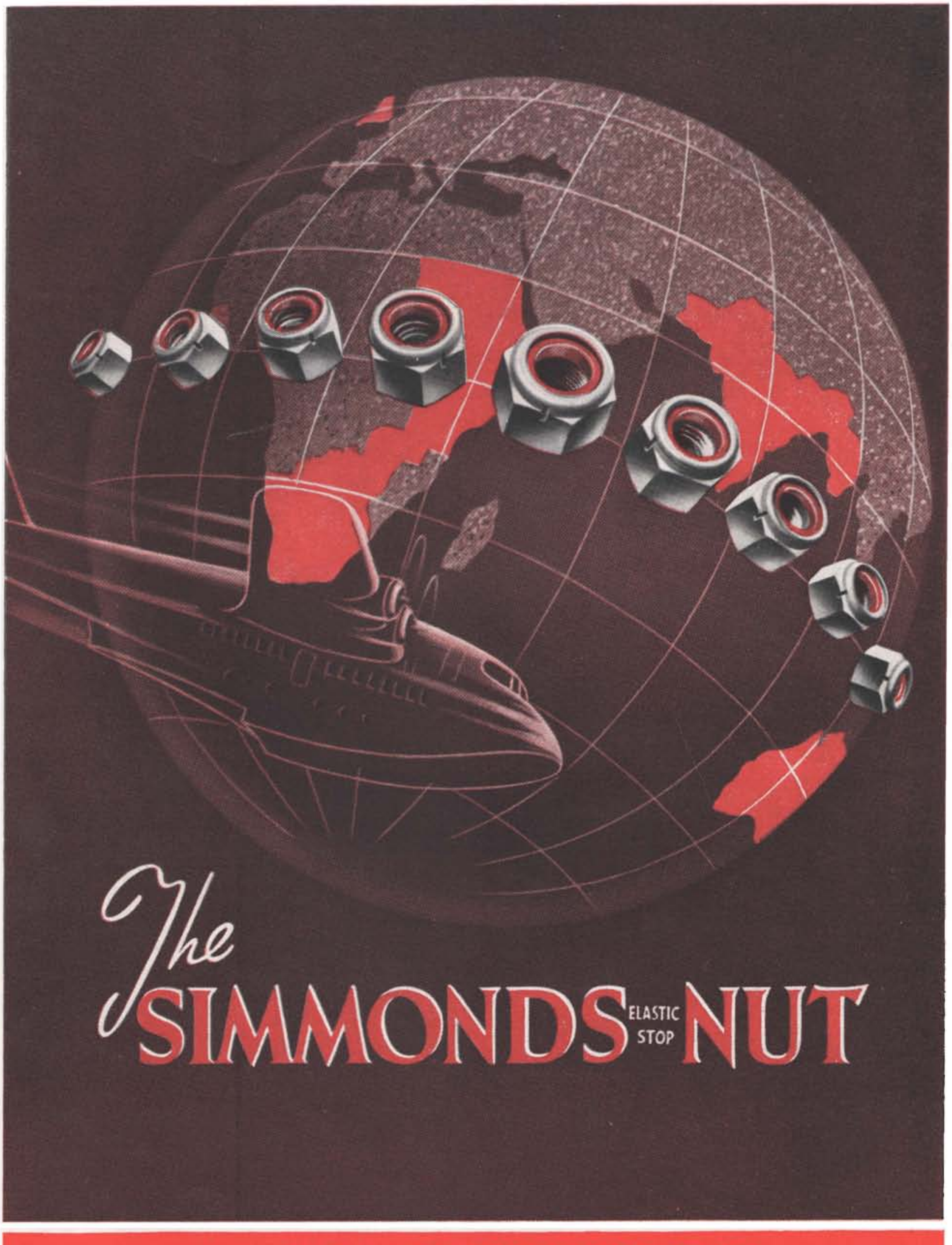
How Luftwaffe Functions

In the controversy about whether the Air Force should be an independent command, correspondents to Aircraft have quoted the organisation of the German Luftwaffe to prove that an independent Air Force is desirable. But this survey from the Aeroplane shows that the Luftwaffe is not so independent as some people think.

FROM an administrative point of view, the Luftwaffe is an independent branch of the Services, but strategically and tactically it is dependent on the decisions of a higher authority, the Oberkommando der Wehrmacht (OKW) under Generalfieldmarschall Keitel. Although Goering is technically head of the German Air Force and holds a rank higher that that of Keitel, the chief of the OKW has greater powers. He plans the operations of the German armed forces and allots to the Commanders-in-Chief of the Army, Navy and Luftwaffe the parts their units will have to play in them. Keitel and not the three Service Chiefs, issues the daily communiques.

The chief of the OKW has his own general staff, on which all three services are represented. The Luftwaffe's permanent representative is Colonel General K. Bodenschatz, Goering's A.D.C. in the last war. Through these liaison officers close collaboration between the OKW and each of three branches has been established, and this collaboration is further strengthened by inter-Service liaison officers. The Luftwaffe has one liaison officer each with the Commanders-in-Chief of the Army and Navy, Generals of Aviators R. Bogatsch

(Continued on page 24).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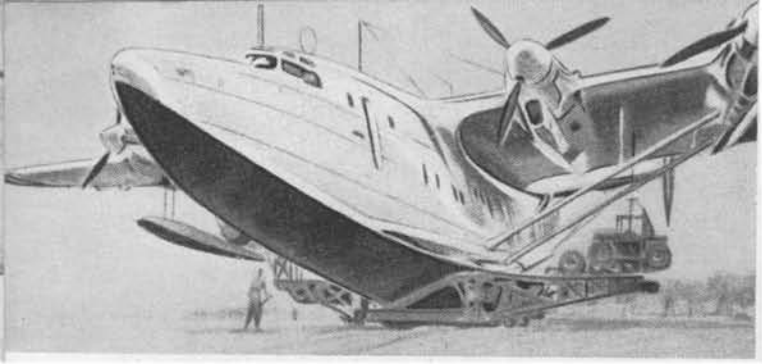

THE POTEZ 161 trans-Atlantic flying-boat (six 1000 h.p. Hispano-Suiza motors) is the first new French aeroplane to be completed since the collapse of France in 1940.

It is an all-metal high-wing strut-braced monoplane with wing-tip floats retractable into the outboard nacelles. The motors are accessible in flight through a gangway in the wings. This gangway is some 78ft. long and, instead of walking, the engineer has a special sliding platform on rails on which he lies.

Dimensions.—Span, 150ft. 10ins.; length, 106ft. 0in.; height, 27ft. 4ins.

Weights.—Empty, about 50,300lb.; loaded, 94,900lb.

Accommodation.—Crew of seven and from 16 to 40 passengers.

Performance.—Max. speed, 220 m.p.h. range, 3,730 miles at 134 m.p.h. against a 37 m.p.h. head wind with a commercial load of 2 tons; landing speed, 75 m.p.h.

By comparison with the Boeing 314 Clipper, the Potez 161 is heavier, has a higher top speed, but lower cruising speed, and is the same length, but has a shorter span.

The illustration above is from a French magazine.

and H. Ritter. These officers have to maintain liaison between the Commanders-in-Chief, direct the operations of those Luftwaffe formations which are immediately under the command of the other two Services and supervise the work of the Luftwaffe officers and their staffs attached to the Groups of Armies, to the Armies, Army Corps, Divisions and Brigades.

Such a complicated scheme for the collaboration of the three Services may be considered cumbersome, and the Germans themselves admit it. Yet, so far, they have not cause to try another. The collaboration of the Army and the Luftwaffe during the Battle of France was judged to be as good as could have been expected.

Since the beginning of the Russian campaign, the collaboration has been further improved by putting a reconnaissance squadron, a wing of dive bombers and a battalion of anti-aircraft artillery under the operational command of each Panzer Division; the aeroplane types are the Hs 126, the Fw 189, the Ju 87B or the Ju 88A6 and, occasionally, the Hs123 biplane dive bomber, up to about 50 in number. Should these aeroplanes require fighter protection, the chief Luftwaffe liaison officer with the group of Armies puts a squadron or a wing at the disposal of the Luftwaffe liaison officer with the individual Panzer Division, who employs them according to the orders of the divisional commander.

Collaboration of the Navy and the Luftwaffe is on similar lines.

From this, the conclusion might be drawn that Luftwaffe units always fight under the command of other Services. That is far from the truth. There have been occasions in this War when operations ordered by the OKW have been directed by officers of the Luftwaffe. This does not include the Battle of Britain, which was a Luftwaffe undertaking from beginning to end, and was directed by Luftwaffe chiefs.

But the conquest of Crete and the withdrawal of the "Scharnhorst," "Gneisenau," and "Prinz Eugen" from Brest to North Sea ports were operations in which Luftwaffe officers commanded military and naval forces as well as air units.

What must always be remembered in assessing the status of the German Air Force is that at one moment it may be the servant and the next the master of the other two Services. German military strategists do not view war from three distinct angles, but from one, and the primary role is given to the Service that must play the most important part.

U.S.A. View of Typhoon

MOST readers appreciate that foreign pilots who have flown the Army P-47 Thunderbolt are keen about it. Some of them in their enthusiasm claim it is the best fighter in the world. The Thunderbolt must be good, for here are some of the data officially released on the best British fighter. It is the Hawker Typhoon created by Sydney Camm, who gave the RAF its Hurricane, Fury and the Hart, each supreme in its day and class.

The Typhoon is a compact, low-wing single-seater equipped with a Napier Sabre 24-cylinder H-type engine. The Sabre is out of the world's most efficient proven (in production) engines. Its efficiency is obtained by a high r.p.m. rate and high b.m.e.p., developing 2350 h.p. for take-off and 1800 h.p. at rated altitude.

The plane travels more than 400 m.p.h. top, but its greatest asset is its high-altitude performance and speed of climb and dive. The RAF officers take pride in pointing out that the Sabre develops more power than the engine which pulls the celebrated London-to-Edinburgh train Royal Scot. Its armament would make even a tank camouflage itself green — with envy. If our Thunderbolt is better it sure is some ship!

—Lt. Col. Harold Hartney, in Flying, U.S.

MANCHESTER

Additional details about Britain's big two-engined bomber, the Avro Manchester, have now been released by the Ministry of Aircraft Production in Britain.

Type: Mid-wing twin-engined all-metal cantilever monoplane with retractable undercarriage.

Engines: Two Rolls-Royce Vulture liquid-cooled engines.
The maximum power rating:
1,845 B.H.P. at 3,000 r.p.m. at 5,000ft. in the low supercharger gear.
1,710 B.H.P. at 3,000 r.p.m. at 15,000ft. in the high supercharger gear.

Airscrews: 3-bladed 16ft. diameter—fully feathering.

Overall Dimensions:
Span 90ft. 1in.
Length, 68ft. 10in.
Height, 20ft.
Gross wing area, 1,131 sq. ft.
Fuselage, 8ft. 2in. deep x 5ft. 9in. wide.
Length of bomb compartment in fuselage, 33ft.
Each main undercarriage wheel, 5ft. 6in. diameter.

Weights and Performance:
Approximately 25 tons all up.
Maximum speed is approximately 300 m.p.h.
Maximum range approximately 2,000 miles.
Bomb load, over 5 tons.

Armament: 3 gun turrets—one in the nose, one dorsal and one in the tail. Altogether 8 Browning guns .303in. are mounted in these turrets.

Crew: A crew of 6 or 7 is normally carried dependent on the operating conditions. It comprises two pilots, air observer (navigator-bomb aimer), W/T operator-gunner (W/T operator's compartment), W/T operator-gunner (front turret), air gunner (top turret), air gunner (tail turret).

Rolls Royce Vulture

SOME two years ago the existence of a new and interesting type of Rolls-Royce, liquid-cooled aircraft engine was revealed. Considerably larger and more powerful than former Rolls-Royce units, the engine, known as the Vulture, has twenty-four cylinders in the form of the letter X—that is, there are four banks, each of six cylinders, mounted at an angle of 90 degrees on a common crankcase. This engine was applied to the Avro Manchester twin-engined heavy bomber, which combination has given satisfactory service on operational duties, notably during the recent heavy raids on N.W. Germany. The engine was also projected for a new fighter type, the Tornado.

The capacity of the Vulture is 2,592 cubic inches, the bore and stroke being 5in. x 5.5in. respectively. Its maximum power rating is 1,845 b.h.p. at 3,000 r.p.m. at 5,000ft. Constructional details largely follow upon Merlin practice in that aluminium cylinder blocks, head and coolant jacket are employed with wet cylinder liners of steel. The crankshaft is carried in seven bearings. Each cylinder has four valves, operated by overhead camshafts following normal Rolls-Royce practice, and two sparking plugs, two independent screened magnetos being used in conjunction with two separate H.T. distributors. Thus the failure of one magneto would not prevent the engine functioning satisfactorily. There is an oil relay for the ignition control.

The X-type engine is of great technical interest and promise.

—Geoffrey Smith in Flight.

THEY WHO LOOK AHEAD....
FROM TIME IMMEMORIAL
BRITANNIA HAS RULED THE WAVES
FROM NOW ONWARD SHE SHALL ALSO RULE THE SKIES
ISSUED BY HELLIWELLS LIMITED · · · SOMEWHERE IN ENGLAND.
MANUFACTURERS & REPAIRERS OF AIRCRAFT & AIRCRAFT COMPONENTS.
AIRCRAFT

Nylon Parachutes

Nylon which recently made front page headlines as the wonder new stocking material, is now being used for parachutes in U.S.A. It is a product of coal, air and water. It is said to be finer and smoother than silk with greater strength and durability. In the above pictures, a girl is seen in three stages of testing a Nylon parachute about to land, emptying the wind on landing, and packing up.

THREE PHASES OF WAR IN THE AIR

U.S. Navy Kingfishers (Vought Sikorsky OS2U-1) which are doing important work in scouting and observation patrols in the South-West Pacific. This single float plane is one of the new types singled out by Rear Admiral Towers, Chief of the U.S. Navy Aeronautical division as having been particularly useful against the Japs. It is also operating in the Atlantic.

Delivery of planes to Mexico by the U.S. was one of the results of Mexico's declaration of war against the Axis. Some new deliveries are seen here lined up on a Mexico aerodrome.

No. 1: Flying Officer EDWARD JAMES (Cobber) KAIN, D.F.C.

First of New Series of Biographies of Fighter Pilots of World War II.

ACES

of World War II

AMONG the great air fighters of World War II, the name of the New Zealander, Flying Officer Edward James Kain, D.F.C., will be permanently inscribed.

"Cobber" Kain, as he was nicknamed, was killed in a flying accident on June 10, 1940, at the age of 22.

The crash occurred in France while a plane was waiting at the airfield to take him back to England. He wanted to do a few stunts before he returned. He tried to loop when his machine seemed to be only 100 feet from the ground. He nearly did it, but one wing touched the ground as he was turning, and, in a second, the machine crashed.

"Cobber" Kain, the first Ace of World War No. II, was the only son of Mr and Mrs R. G. Kain, of Wadestown, Wellington, where Mr Kain is a well-known business man. He was born at Hastings, Wellington, in 1918.

While a boy, attending the Croydon School, at Day's Day, Wellington, he used to make model aeroplanes out of soap boxes. To obtain the boxes, he would run errands for the local grocer.

The future Ace continued his studies at Christ's College, Christchurch, Wellington. At the age of sixteen he had an insane craze for flying. He pestered his parents to allow him to take up flying as a career.

In 1936, his keenness led him to be selected by the New Zealand Air Board to go to England to train as an RAF pilot. This was under an agreement that existed between the Governments of New Zealand and England. His parents relented, and he set off for England to realise his cherished ambition.

On the day after he arrived in London, he went to the Air Ministry to sign on. But fate was unkind to him. He failed in his medical test. Too big for his age, he had overgrown his strength. He was told to come back in a couple of months.

Before the two months had passed, he had applied again and was accepted.

With unbounded enthusiasm he began his training as an RAF pilot, and for the next two years he went through a gruelling course that turns out the most thoroughly trained airmen in the world.

He studied English, World History, Aerodynamics, Mechanics, Mathematics Mechanical Drawing, the construction of engines, airmanship, air navigation and wireless telegraphy.

In his second year he studied advanced navigation, armaments, flight routine, signals law, meteorology. the workings of the Army, Navy and Air Force.

Towards the end of his second year, Cobber Kain was stationed at the Advanced Training Squadron, where he was taught all about service flying—bombing, fighting, etc., by day and night.

At length a great day arrived for our hero. He received his wings and was posted to 73 Squadron.

His all too brief career marked Kain as one of the best type of RAF fighter pilots. He disregarded all matters of personal safety when combat was joined, and some of his most brilliant successes were won through his terrific drive, which sent him through any odds to achieve his immediate purpose.

Members of his Squadron spoke of him affectionately as a "mad devil," and it was undoubtedly this streak of recklessness, controlled by cool thinking, that gave him so many victories over the enemy in a short space of time.

Kain was unofficially credited with more than forty German planes at the time of his death.

Officer Kain's favorite mount was a Hurricane, and his chief quarry were Messerschmitts—nearly always superior in numbers. Once, after shooting down two from a formation of Messerschmitts, his Hurricane was struck by a shell and set on fire. Wounded in the hand and leg and badly burned, he bailed out over No Man's Land and escaped into the Maginot Line.

On another occasion, after destroying one or two Germans, he was temporarily stunned by a Messerschmitt shell that set his Hurricane aflame, and recovered consciousness just in time to bail out before his machine crashed.

The aeronautical correspondent of The Times, writing of his first meeting with Kain, after he had shot down his first enemy aeroplane, said: "As I drove up to the small French village where his squadron was

(Continued on Page 38)

Runway hacked out of the Australian bush for American fighter aircraft.

The R.A.A.F.

Notes about Australian Airmen at Home and Abroad

PROMOTION of two members of the Air Board, Group-Captain E. C. Wackett and Group-Captain G. J. W. Mackinalty, to the rank of Air Commodore was gazetted early in August.

Air-Commodore Wackett is the Air Member for Engineering and Maintenance, and Air-Commodore Mackinalty is Air Member for Supply and Equipment.

Ellis Charles Wackett, O.B.E., is a member of a family whose name is linked closely with Australian war aviation. He was born in August, 1901, and resides at East Kew, Victoria. A graduate of Jervis Bay College, Air-Commodore Wackett became a Flight Lieutenant in the Air Force in 1923. Prior to that, he was a member of the Royal Australian Navy. Several months ago, while R.A.A.F. Director of Technical Services, he was appointed to the Air Board.

George John William Mackinalty, O.B.E., was Director of R.A.A.F. Equipment when he was appointed to the Air Board in June last. He was born in March, 1895, and prior to joining the Air Force, in August, 1921, resided at Auburn, Victoria. Air-Commodore Mackinalty served in the last war.

Pilot In Five War Theatres

FIGHTING Axis airmen in Abyssinia and the Middle East, a week in Russia with the R.A.F., and an amazing escape from Java in a ship's lifeboat after the Japanese had taken possession. Those were among the wartime adventures of Sergeant George Sayers, 29 years old Melbourne pilot, who recently returned to Australia, and is now serving with a R.A.A.F. operational station in N.S.W. Sayers has over 900 flying hours to his credit, and has taken part in 43 operations against the enemy.

Leaving Australia in April, 1940, Sergeant Pilot Sayers joined a R.A.A.F. Hurricane squadron in the Middle East, and was later posted to a R.A.F. Blenheim bomber squadron in Abyssinia, operating against the Italians. His squadron carried out raids over the capital, Addis Ababa, after its occupation by the Italians, blockaded by the French port of Djibouti, and helped to strafe Axis forces when they temporarily occupied part of British Somaliland.

"Italian pilots in Abyssinia were the best of the Axis airmen I ever encountered," states Sayers. "None of the civilians whom I met wanted war. Prisoners captured by British troops were allowed to roam round unattended and gave no trouble whatever.

"There were about 40 per cent. of Australians in the R.A.F. squadron," he said, "and they gained a wonderful reputation as observers. There were practically no landmarks in the desert—a fact which gave the Australians ample scope to show their skill in navigation. In December, 1941, there were scarcely any German aircraft in the skies of the Middle East, where the R.A.F. and R.A.A.F. shot up the German ground troops without opposition."

Sergeant Sayers spent a week with a R.A.F. fighter squadron in Russia, and formed a high estimate of Soviet pilots' fighting capabilities. They took the war very seriously. The same applied to the whole civilian population, which was 100 per cent. war-minded.

Returning to the Middle East, Sayers flew with a R.A.F. bomber squadron to Singapore via India and Burma, and was in Singapore only a few days before it fell.

"From Singapore we went to Sumatra, which was raided 21 times during the 21 days we were there. From Sumatra we went to Java, where we raided Japanese-occupied aerodromes in Sumatra. I think I was the last Australian to fly in Java before the island was captured by the Japs. On one occasion I was shot down about 250 miles from our base and landed in a rice field near Rangas Peiton, with an English observer and an Australian gunner. We walked round for two or three hours looking for transport, but all we could find were three push bikes. On the island there were six tanks which the Japanese had captured in Malaya, but we saw only one Javanese native. We bailed him up with a revolver and demanded cigarettes. He dropped them on the ground and ran like a hare.

"We found the Japanese fearless and efficient, both as bombers and fighters, and they would always attack at any time without hesitation."

Recounting the amazing story of the escape of 12 R.A.F. and R.A.A.F. men from Java in a ship's lifeboat after the Japanese had taken possession, Sayers said that the party was at sea for 44 days and covered 1500 miles of ocean.

"During our long voyage in an open boat we were scrutinised by a Jap submarine, which for some reason or other allowed us to proceed. On another occasion we were almost capsized by a large whale, and were successively becalmed and swept by violent storms," he said. The party consisted of Wing-Commander Jenkwine, Pilot Officer Streathfield, Squadron-Leader Passmore, and Pilot Officer Macdonald, of the R.A.F., Sergeant Pilots Lovegrove, Cosgrove and Longmore, Sergeant Observer Snook, Sergeant Gunners Hayes and Corney, and myself."

Sergeant Sayers was educated at Scotch College, Melbourne, and Melbourne University, where he was doing a law course before enlistment with the R.A.A.F. He enlisted with Squadron-Leader Keith Truscott, with whom he did much of his early training in Victoria and N.S.W. Truscott's R.A.A.F. number is 400212, and Sayers's 400213.

Second Award Earned

SYDNEY born bomber pilot serving with the R.A.F., Acting Wing Commander Howard Clive Mayers, D.F.C., aged 31, has been granted an immediate award of the D.S.O. The citation of the award stated that twice last May, Acting Wing Commander Mayers led attacks on aircraft carrying supplies to the enemy, and destroyed many of them.

He had been in command of his wing since April and was an expert in tactical matters. This knowledge had contributed largely to the success of long-range fighter operations. He was also an expert in bombing and machine-gun attacks. Acting Wing Commander Mayers was reported missing soon after the announcement of his second award.

Convoy Duel

NINE Australians, the crew of a Sunderland flying boat, had an extraordinary experience—and escape—while attacking an enemy tanker convoy in the Bay of Biscay recently.

Captain of the aircraft was Flight-Lieutenant R. W. Marks, of Norwood, S.A.; first pilot was Flying Officer

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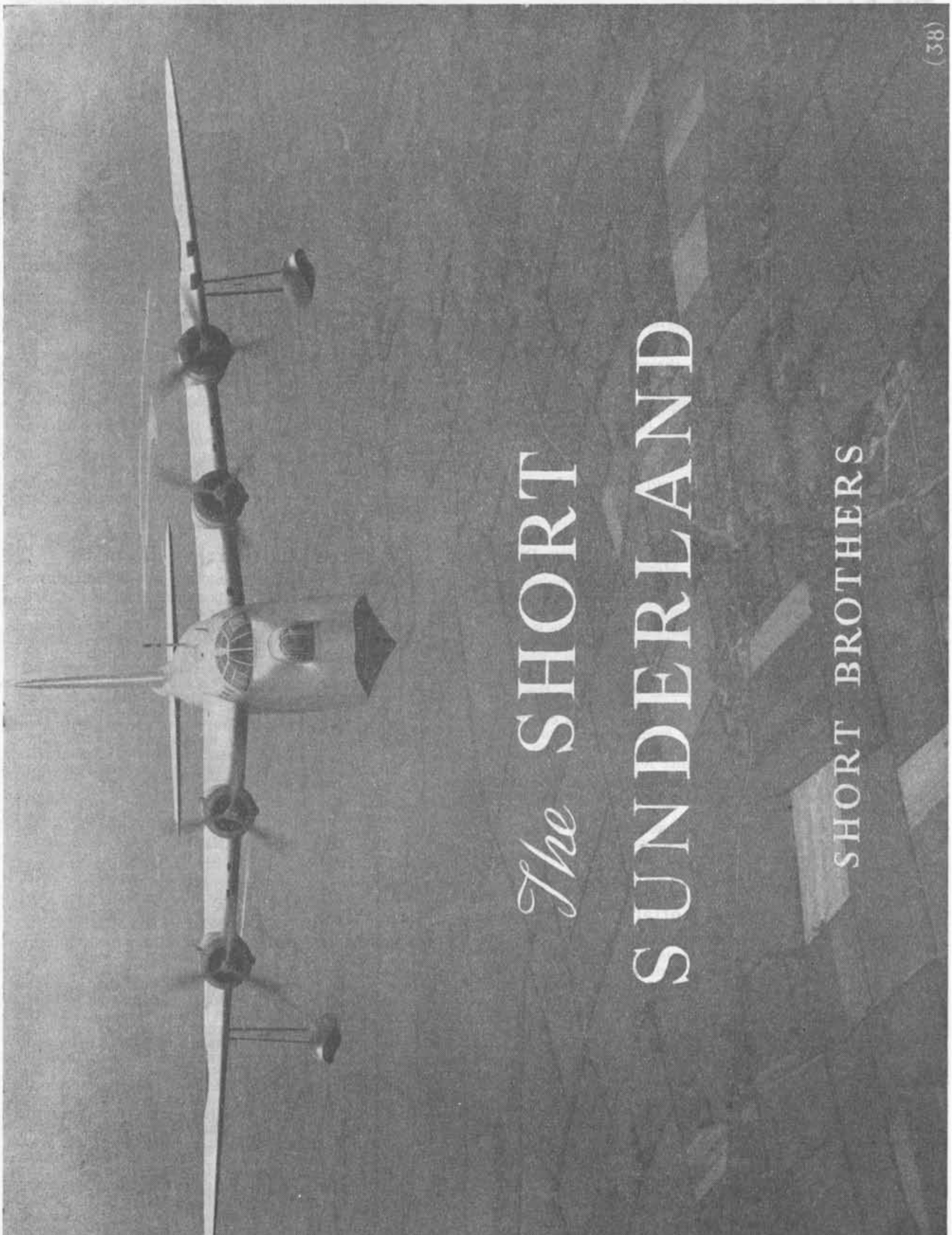

The SHORT
SUNDERLAND
SHORT BROTHERS
(38)

H. D. White, of Brooklyn Park, S.A.; second pilot was Flying Officer W. P. Thorpe, of Balaclava, S.A.; the navigator, Pilot Officer J. S. Portus, of North Adelaide; the first fitter, Sergeant J. W. Keily, of Moe, Vic.; second fitter, Leading Aircraftman A. M. Ellis, of Glen Innes, N.S.W.; first wireless operator, Sergeant R. Trenberth, of Brighton, Vic.; second wireless operator, Sergeant R. E. Jackson, of Caulfield, Vic.; and the rigger, Aircraftman J. A. Dickson Smith, of Carnegie, Vic.

The Sunderland was preparing to attack the tanker when the front gun-turret jammed, and for half an hour the Sunderland circled within range of enemy fighters and anti-aircraft guns, while the gunner worked on the turret.

When the Sunderland again tried to attack the convoy, a Messerschmitt 109 dashed in, but a burst from the Sunderland sent the Messerschmitt blazing into the sea. Then a heavy shell smashed the Sunderland's hull and exploded. The captain felt the wind of one fragment which passed his face, chipped the wheel control column, and went out through a porthole beside him. Another splinter set fire to a flare which the navigator picked up and threw away. Both the Sunderland's inner engines were damaged and another was put out of action.

The flying boat landed at its base, and within two hours she was being repaired and equipped for another trip over the Bay of Biscay.

D.F.C. For Balgowlah Pilot

"FORGET the fighters, get the bombers," shouted Acting Squadron-Leader Robert Henry Gibbes, aged 26, of Balgowlah (N.S.W.) to his fighter squadron in recent operations in the Western Desert. His plane was shot down by a Messerschmitt 109 as he led the attack, and he was injured as he baled out. For his conspicuous part in this action, he was awarded the D.F.C.

Acting Squadron-Leader Gibbes, an Empire Air Scheme trainee, who was a salesman before he enlisted in the R.A.A.F. in February, 1940, saw service in England before being posted to the Middle East.

His instruction to his squadron to ignore the risk of fighter attack and concentrate on the heavily-laden bombers, was heard over the radio by the controller in the operations room. The engagement took place with a larger formation of Junkers 88's, which were heavily escorted by Messerschmitt 109's.

Having shouted his instructions, Gibbes led the attack on the bombers, although it made him an excellent target for the fighters.

Gibbes's determination on all occasions to deal with enemy aircraft has inspired his companions and has given Gibbes six enemy aircraft destroyed for certain and 14 others probably destroyed.

New Methods In Aerial Fire Power

SELECTED wireless operator-air gunners and air gunners are to receive special training in a newly-formed central gunnery school from which they will emerge target selectors and fire co-ordinators and controllers for the squadrons to which they are posted. The qualities deemed necessary for a gunnery leader include the following:—

He must be a wireless operator-air gunner or air gunner, preferably an officer, though this did not debar N.C.O.'s with the necessary qualifications from being selected for the course.

It was desirable that he should have had operational experience; should have a full knowledge of air tactics in its relation to air gunnery; and possess the qualities of leadership. A sound knowledge of the theory of air sighting, the ability accurately to estimate ranges, and to identify enemy aircraft immediately were essentials.

The duties of a gunnery leader consist of advising flight commanders and the squadron commander on all matters connected with air gunnery; to ensure that all air gunners were kept up to date in the latest methods of training; and to check all guns, sights, magazines, etc., in the squadron each day.

In addition, he must gain the confidence of pilots and aircrew, so that they would unhesitatingly take his advice when in action, and he must work out tactical problems for all formations in attack.

By means of this new procedure it is hoped to increase greatly the effective fire power of operational squadrons.

A.T.C. Now An Auxiliary To R.A.A.F.

A.T.C. cadets who become 18 are not now liable for service in military camps. It has recently been officially recognised that the A.T.C. is an auxiliary of the R.A.A.F., and that its members are Air Force Volunteers.

The procedure to follow for those desirous or enlisting in the R.A.A.F. is that you must first obtain from your squadron commander a certificate of membership of the A.T.C. When you report at the military area office in answer to the universal call-up, you should attach this certificate to your registration for military service.

Also, before you can enlist in the R.A.A.F., you must have obtained your parents' consent. So armed, you may attend at the recruit centre for medical examination and selection as member of air crew or ground staff, in whichever direction your fancy lies. Under the agreement reached between Army and Air Force, this certificate of membership of the A.T.C. is the guarantee to the area officer that he may disregard you as a candidate for militia, and pass you on to the R.A.A.F.

But it should be realised that this recognition of your membership of the A.T.C. is not the open sesame to the R.A.A.F. There is an obligation on you, too. It is expected that you should have been in regular attendance at your parades on week nights and Saturday afternoons, and have worked hard in mastering the various subjects on the A.T.C. syllabus.

Picked Up Blazing Bombs

BY picking up blazing incendiary bombs and throwing them from a R.A.F. bomber which was attacking targets at Visborg, an Australian wireless operator probably saved the aircraft. For his courage, he has been awarded the Distinguished Flying Medal. He was Sergeant Hugh Alexander McLennan. A box of incendiary bombs broke loose from its stowage, and two of the bombs ignited. McLennan, with his bare hands, picked up one blazing bomb and endeavored to throw it through the escape hatch. He was, however, unable to open the hatch, and with great presence of mind he pushed the burning bomb through the fabric fuselage. In spite of his burns, he then picked up the second blazing incendiary, and thrust it through the hole on to the town below.

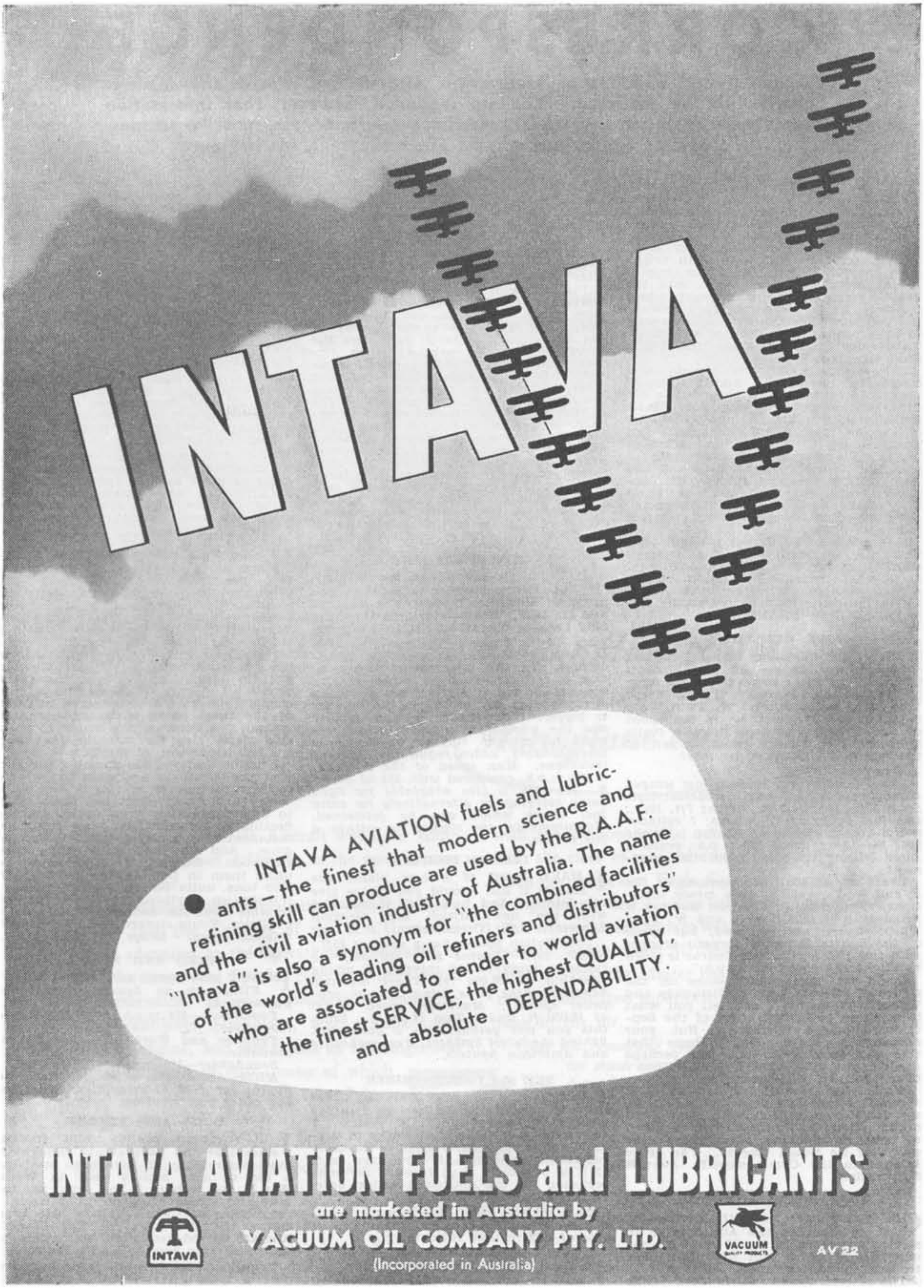
McLennan, who is 26 years of age, lived at Temora (N.S.W.) before enlisting in the R.A.A.F. on January 5, 1941. Before the war he was a member of the 40th Machine-Gun Battery (N.S.W.), and he holds an air gunner's badge of the R.A.A.F.

Fought Fire In Air

PILOT OFFICER THOMAS EDWARD WHITE HOWES, of Toowong, Brisbane, a navigator serving with a mixed squadron in the Middle East, has been awarded the Distinguished Flying Cross for gallantry in air operations. Howes was the navigator of a bomber raiding enemy concentrations in the Desert late in June. A burst of fire from an enemy aircraft caused the failure of the intercommunication and lighting systems, and set the bomber on fire. The pilot and wireless ojerator were wounded in the legs and body by cannon fire.

After helping to bring the two men back to the cabin, Howes put out the fire that was spreading up the walls of the cabin. He then noticed that another fire had broken out in the rear turret. The rear gunner, who was a man weighing more than 13 stone, had been badly wounded, and Howes, after extinguishing the flames in the gunner's clothing, freed him, with difficulty, from his turret, and administered morphia to deaden the pain he was suffering.

For their part in the incident, the pilot, Flight Sergeant Ernest Leslie Joyce, a New Zealander, and Sergeant Claude Weaver, the rear gunner, were each awarded the Distinguished Flying Medal. Howes was born at Brisbane in August, 1922. He is unmarried, and before enlisting in the R.A.A.F. in December, 1940, he was employed in the freight office of Qantas. He received his flying training under the Empire Air Scheme in Australia, Canada, and the United Kingdom.



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CORRESPONDENCE

Comment and opinions of features in Aircraft are invited and readers' queries will be answered. You are reminded, however, that information about new types of aircraft is sometimes restricted for security reasons. Address: Editor, Aircraft, 62 Flinders Street, Melbourne.

JAPANESE ZERO

Sir,—Why cannot we have more competent war correspondents in Australia? One in particular, to whom I am referring, does not seem to have had any previous aeronautical study, and never having seen any other fighter in action than the Kittyhawk, and a far view of Zeros, has no right to claim that the Zero is definitely one of the world's best fighters. He does not take into account the fact that their "superiority" lies only in their powers of manoeuvre and climb. These qualities do not mean that it is a good aeroplane.

For example, all early models were structurally very weak, and a terminal velocity dive would rip their wings off. Also, the equipment was poor, their armor was insufficient, to say the least of it, and their petrol tanks were not puncture proof. Their much talked of "cannon" armament consisted only of two rifle calibre machine guns and two .5 in. calibre machine guns. Their engines were of very low power, as far as modern standards go, and I had expected a ceiling of at least 30,000 feet, whereas it is only 26,000.

However, I admit that it is about time that we over-estimated the enemy's strength, rather than add to the series of defeats due to under-estimation, but as a patriotic aeronautical enthusiast, I do like to hear the truth about enemy aircraft.—ERIC J. BRADFORD.

FIVE QUESTIONS

I HAVE five questions to ask you. Are there any figures of the Wackett Trainer? Is there more than one type of Pratt and Whitney Twin Wasp? What h.p. is the P. and W. Twin Wasp being made in Australia. Is the speed of the British Beaufort Bomber really known? Is anything really known of the Australian Beaufort Bomber?

Here goes:

The Wackett Trainer is a low winged monoplane with fixed undercarriage. Span 37ft., length 27ft., height 7ft. 10in.; two fuel tanks of 17 gallons; 7 cylinder radial Scarab engine of 165 h.p. Weight 2617 lbs. Max. speed 120 m.p.h., cruising speed 105 m.p.h.; ceiling 14,500. No armament.

There are at least six versions of the P. and W. Twin Wasp with minor variations. The R.A.A.F. Beaufort Bomber is fitted with a 1200 h.p. P. and W. Twin Wasp. Speed not disclosed, but speed of the British Beaufort torpedo dropper with two 1065 h.p. Bristol Taurus is given in Flight as "about 300 m.p.h."

Could we have other planes on the covers of Aircraft besides Wirraways and Wackett Trainers? I can tell you what is going to be on the cover of the September issue—a Wirraway. But your magazine is quite good. I hope that this will solace you, but you perhaps don't care a cuss what I think (I don't blame you). A.I., Warrnambool.

While trying not to be too thin skinned, I wouldn't go so far as to say we don't care a cuss what you (and SOME others) think. But we're sorry we can do nothing about the cover much as we would like to. The space belongs to the Commonwealth Aircraft Corporation.

AIRACOBRA CANNON

CAN you supply me with information as to whether the Airacobra is in service anywhere in its 37 mm. cannon version? All those sent to Britain seem to have 20 mm. cannon.

The 37 mm. cannon is standard fitting for Airacobra supplied to the American Army Air Corps. So you can form your own conclusions as to its present day operation.

ILL-NATURED ABUSE

IN reply to R.W., Griffith.

Your observations on separate command of the Air Force are to the point, but your reference to Lord Trenchard is ill-natured abuse that shows your complete ignorance of the career and character of one of the most notable figures in the history of military aviation. Your comments on British fighter aircraft also show much ignorance and ill-natured bias. You quote Hurricane figures of five or six years ago as if they were the latest achievements of the British Aircraft industry. The same applies to your comments on Swordfish, Whirlwind and others. You've even got a grouse against the Typhoon which is ahead of the Thunderbolt in production and performance. I am sorry that it annoys you that the concensus of opinion, including American, is that British fighter aircraft have always led the way, but the only thing you can do about it is to keep it to yourself and not try to rush into print with all this jealous abuse. That's fifth column stuff which disgusts me. Fortunately yours is the only letter of its kind ever received by Aircraft.

MESSERSCHMITT 109 E & F

WILL you please advise me through your correspondence column the principal difference between the Me 109E and Me 109F. Has a later type than the 109F been in operation? R.H. (Lismore).

Me 109F is basically the same machine as the Me 109E although there are modifications. In the later model the wing tips have been rounded although the taper is the same. Me 109F has a smaller airscrew diameter although the spinner is bigger. The rudder is also smaller and the wheels are placed further forward to prevent tipping on its nose when landing, which requires a different technique. Max. speed of the F model is 370 m.p.h. compared with 354 of model E. Me 109F is also adaptable for light bomb carrying, or alternatively for extra fuel tanks which can be jettisoned. Measurements are similar to within a few inches.

ITALIAN FIGHTER

I HAVE heard of a new plane, the Macchi C 202. Could you please give me details. And how does it compare with the new British and German fighters? G.C. (Greenthorpe).

This Italian fighter has a span of 35ft.; length 20ft. Engine is 1 DB 601N 12 cylinder liquid cooled inverted V giving 1200 h.p. at 16,000 ft. There are two heavy machine guns firing through propeller spinner. Maximum speed is 330 at 18,000 ft. and ceiling 34,500 ft. From this you will gather it is a good deal behind the latest Spitfires, Messerschmitts and American fighters.

NEW A.T.C. SUBSCRIBER

I AM joining the Air Training Corps and I would like to become familiar with the different kinds of planes. I have read a few kinds of copies of Aircraft and would like to say it is the most interesting magazine I have ever read. If it is possible I shall forward my subscription at the earliest possible date. P.F.L. (Riverview).

Thanks for your kind remarks, Pat. We shall look forward to having you as one of our regular subscribers.

A.T.C. SECTION?

I HAVE read several back numbers of Aircraft and notice you have a section for the R.A.A.F. Is it possible to run such a section for the Air Training Corps? F. L. Henderson (Glandore, S.A.).

We want to enlarge Aircraft and devote a special section to the A.T.C. in addition to existing features. But for this purpose we need special permission to use more paper which we are trying to get. Your letter is very timely.

SPITFIRES AND SWORDFISH

AIRCRAFT in June called Spitfires Vickers-Armstrong Spitfires. I always thought they were Vickers-Supermarine. Which is correct? P.T., Kingaroy.

In October, 1938, the Supermarine Aviation works (Vickers) Ltd. were taken over by Vickers Armstrong Ltd., so that Vickers Armstrong is the proper name of the makers of Spitfires today.

I have read that the speed of Fairey Swordfish, torpedo carrying plane of the Fleet Air Arm, has a speed of only 154 m.p.h. How is it that they have bombed so many ships, fought planes and returned?

Most of the Swordfish successes belong to a period when opposition was not quite as great as it is today when they are regarded as obsolete and rapidly being replaced. The courage of their pilots has been almost superhuman.

SCHNEIDER CUP WINNER

IN your July issue, I notice a photograph of a Sopwith machine which you describe as having won the Schneider Cup at Monaco. Actually the machine you show was built for the Circuit of Britain seaplane race after Sopwith's had won the Schneider with a single seat, single bay, biplane.

The Circuit of Britain seaplane race was cancelled owing to the outbreak of war, in 1914. The pilot in the plane shown is Victor Mahl, and on the original picture the writer stood in front of the prop, along with another Australian, Bob Cousins. We helped to build this plane, also the machine that won the Schneider Cup at Monaco.

I notice that you are stressing the fact that the Allies do not seem to be able to learn lessons out of this or any other war. How much effort has been made to apply invention to a device for deflecting a torpedo from the ship, for instance? Personally I think it can be done. And why not build sub surface freighters. Germany is reported to be using them in the Mediterranean up to 6000 tons, quite obviously a solution.

Wake up anything in the nature of possible solutions, and give them a little publicity. Yours sincerely—H. C. MILLER (MacRobertson - Miller Aviation Coy., Perth).

SPEED AND RANGE

PLEASE give speed and range of the:

Kittyhawk—no figures released for publication.

Tomahawk—328 m.p.h. at 15,000. Range 700 miles.

Typhoon and Warhawk — no figures available.

Beaufighter—330 m.p.h. Range 1500.

MIG3—About 360 m.p.h. I have no figures for I-26 Stormovik, or SU-2, or the other you mention.

BORE AND STROKE

I HAVE been reading your journal since 1934 and have always thought it most interesting. I have been studying a list of aero motors used in World War I., and wonder if you could tell me bore and stroke of them. Also could I get photos of them? I have also been trying to get Jane's All The World's Aircraft second-hand; but booksellers do not stock this book. H.D.T., Scotsdale.

Yours is certainly a tall order, but here goes:

There is a gap in my reference between 1916 and 1922, so the figures I am giving are a little later than you ask for but may be near enough to assist your purpose.

(Continued on page 36)

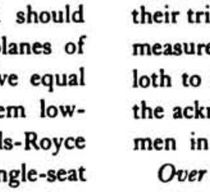
Milestones . . . 1939

MILES 'MASTER'

"Monoplane Pilots need Monoplane Training"

NO history of Miles Aircraft would be complete without reference to the now famous Miles Master.

The Master was the realisation of Mr. Miles's dream that the Trainers of the R.A.F. should be as advanced as the operational aeroplanes of the Hurricane and Spitfire class and have equal characteristics. It was a two-seat tandem low-wing cantilever monoplane, with a Rolls-Royce Kestrel engine, and was as fast as the single-seat biplane fighters of 1935, many of which were still then in service. Every fighter pilot in the R.A.F. now receives initiation into fighter tactics in a Master. He goes from initial to operational school with the confidence that comes of being familiar with the class of aeroplane he will fly in combat. Even the American Eagle Squadron, experienced flying men all, flew Masters before Hurricanes, and their tribute to the trainer was high. In this small measure, credit which Mr. Miles himself would be loth to claim, the Master has thus contributed to the acknowledged superiority of Britain's fighting men in the air.



Over the remaining years between 1939 and now we must draw a discreet veil. And for the future, what can we say—except that Miles Aircraft will be there with Wings for the World's air-minded in the form that best suits the needs of the great To-morrow that will dawn with Peace . . . .

Miles AIRCRAFT

CONSTRUCTED BY PHILLIPS & POWIS AIRCRAFT LIMITED SOMEWHERE IN ENGLAND

» MASTERS OF THE AIR «

(D.M.6)

CORRESPONDENCE—Contd.

Bentley BR2, 9 cyl., 250 h.p., 140 x 180 mm. Siddeley Puma, 6 cyl., 240 h.p., 5.7 x 7.5 in. Rolls Royce Falcon, 12 cyl., 270 h.p., 4 x 5¾ in. Clerget, 9 cyl., 105 x 140 mm. Salmson, 9 cyl., 150 h.p., 120 x 152 mm. (this one only, a 1915 engine). Benz, 6 cyl., 225 h.p., 140 x 190 mm. Beardmore, 6 cyl., 180 h.p., 142 x 175 mm.

Your only hope of getting photos would be to write to the makers and even then I think the chances are remote. Also I don't like your prospect of getting a second-hand copy of Janes. Advertisement in the wanted columns is your best chance, unless some reader of Aircraft has a copy he would trade?

NAVY AMPHIBIANS

DID a Saro "Cloud" Amphibian ever exist? (J.I., Woongatta.)

Yes. This member of the Saunders Roe "Saro" family was a commercial and military amphibian operating around 1934. It had a maximum speed of 118 m.p.h., ceiling 14,000 ft., with two 340 h.p. Armstrong Siddeley "Serval" radial air cooled engines. It was used mainly for Flying and Navigation training for the Navy and had a cabin for 8 passengers or pupils.

Is the Supermarine Seagull V in production?

Yes, with modifications. It is the British Walrus used for catapulting from warships and is being generally hotted up.

What is the standard amphibian of the United States Navy?

The Grummann JRF-2, used by the coastguards, is the most common type. It has 2 Pratt and Whitney Wasp Jr. engines. High speed 200 m.p.h. Ceiling 22,000 ft. Range 1000 miles. There is also a Sikorsky JRS-1 in operation, but I have no details. Nor can I answer the query about Grummann A-31A amphibian.

CRITICISMS

G.C., BRISBANE.—Many thanks for your bits of information and criticisms, some of which I think are sound although others I disagree with. Performance figures of the Wackett Trainer which you ask for are given in reply to another reader.

PERFORMANCE DETAILS

COULD you supply me with any details of the performance figures of these five planes: Fairey Fulmar, North American Harvard, Short Singapore, Airspeed Envoy, Vega Ventura.—C.M. (Carisbrooke).

FAIREY FULMAR: Two seater Navy fighter with 1 Rolls Royce engine with 1145 h.p. at 5250 ft. Normal range 1000 miles; speed 250-300 m.p.h.

NORTH AMERICAN HARVARD TRAINER: 1 Pratt and Whitney Wasp, 550 h.p. at 5000 ft. Max. speed 206 m.p.h. Ceiling 23,000 ft.

SHORT SINGAPORE, Navy Reconnassance: 2 Rolls Royce, each 800 h.p. Range 760 miles. Max. speed 145 m.p.h.

Figures for the Airspeed Envoy and Vega Ventura are not available.

TOP SPEEDS

I LIKE Aircraft tremendously and think the introduction of Correspondence a very good idea. I would be very grateful if you would answer these questions. What is the top speed of the Kittyhawk, Lockheed Lightning and Douglas Boston? (R.J., East Geelong).

Kittyhawk figures have not been released. Lockheed Lightning has 404 m.p.h. at 16,000 feet, and Douglas Boston, DB-7, 305; DB-7A, 315; and DB-7B, 350 m.p.h.

What is the idea of two fuselages in the P-38?

This is an aerodynamic experiment designed to reduce drag.

Is the Douglas B-19 in production?

Experimental work on the B-19 is concluded satisfactorily, I understand, but there has been no announcement that it has been ordered by the U.S. Army.

BALING OUT

I AM curious to know how a fighter pilot could bale out of an Airacobra. The car type doors that you mention in your April issue would be practically impossible to open against the wind while travelling at speed. I would also like to take this opportunity of congratulating you on your excellent magazine. (G.C., Toorak).

The Airacobra has a lever which the pilot can press in emergencies, causing the whole door to fall away.

2600 H.P. IN 1931

WHAT is the range and ceiling of the Hawker Demon that arrived here in 1935? (G.N., Sydney).

Service ceiling was 21,000 feet. Unable to tell you the range.

Was there an I.A.R. 80 Rumanian fighter and, if so, what was the top speed, engine, h.p. and armament?

The I.A.R. 80 is a comparatively recent type. Engine is 1 IARK 14-cyl. air cooled radial, supercharged to give 940 h.p. at 11,170 feet. Speed 317 m.p.h. at 13,000 feet. Service ceiling 34,000 feet. Armament 4 m.g.'s in wings.

Was interested in the remainder of your long letter, but I do not wish to revise the figures given in Aircraft except possibly the Brewster's ceiling may have been too low. I notice another authority places it at 35,000 feet. Fw 190's engine is a 1600 h.p. BMW as stated. Most of the figures you quote are not in accord with information later than yours. Other readers may be interested in your reminder of the Rolls Royce "R" racing Buzzard which won the Schneider Cup trophy and was boosted to 2600 h.p. to give world's speed record of 407 m.p.h. in 1931—truly a masterpiece of British engineering.

SCARCELY SCIENTIFIC

I HAVE a cutting from Popular Science of two years back stating that the Lockheed XP-38 has a top speed estimated at 500 m.p.h. and that the Boulton and Paul Defiant has an armament of 18 m.g.'s. Is this true? (D.W., Enfield).

Your Popular Science appears to be more popular than scientific. XP-38, now P-38's top speed is 404 m.p.h. The Defiant's armament consists of one four-gun B.P. turret in the upper section of the fuselage amidships.

AERO CLUB OF N.S.W.

MEMBERS.—The following new members were elected to the club at the last meeting of the committee: I. A. W. Dye, B. Howitt, R. H. Arneson, R. Opie, K. W. Bardsley, R. J. Smith, M. T. Pruss, G. D. Richardson, R. B. Orr, G. W. Canacott, G. Marshall, L. S. Bolton, J. D. Sleeman, F. K. McManis, J. E. M. Laffan, F. A. Schubach, R. C. Crebbin, L. H. Murray, S. Edwards.

PILOTS.—V. H. Shuback and T. R. Young.

FLYING ACTIVITIES. — The total flying hours for the month of July were 102 hours 45 minutes. Not as many hours were flown during July as in the past months owing to westerly winds.

During the month of July 45 different pupil members flew club aircraft.

"A" LICENCE.—Mr B. Howitt has passed the necessary tests for "A" licence. Messrs. Arneson, Dye, Marshall and Laffan have just passed their first solo flights. Mr J. Burnet has completed his night flying to qualify for "B" licence.

FLYING OFFICER KAIN

(Continued from Page 28)

stationed, black smoke was rising in a column on the brow of the hill from where his first victim had fallen. Kain seemed almost unmoved by his experience. He gave a detailed account of the tactics he had employed in the combat, and described every movement of the enemy aeroplane calmly and carefully. He had set tactics against tactics, but he added to these his own zest and fire."

In March, 1940, he was awarded the Distinguished Flying Cross for having shot down five enemy planes.

Soon after he arrived in England, "Cobber" Kain formed a friendship with pretty blonde Joyce Phillips, a repertory actress, of Peterborough. Their engagement was announced in April, 1940, and they planned to settle in New Zealand after the war. It is the irony of fate that, on the day Kain was killed, he was to return to England to make plans for his wedding. C'est La Guerre.

Kain was a tall six-footer. He was thought to be untidy by some. His hair always wanted cutting, his trousers could always do with a press, and his flying boots cracked twice as fast as those of his colleagues.

He always wore a lucky charm around his neck. It was a green jade Maori tiki, or god. He was not superstitious, but he wore it because it was a present from his sister.

RAF Censorship prevented the name of the first Ace being used too frequently in stories of the 73 Squadron, with the result that his heroic deeds became more known in France than in England. He became France's first hero of the war, and his name was a household word in France.

What little publicity Cobber did receive, in the English papers, worried him.

Truly a hero, Kain was generous-hearted and modest. He never bragged of his deeds. He was popular with his colleagues and was the most toasted member of 73 Squadron.

The war's famous Ace, the hero of a hundred air battles, lies beneath a simple wooden cross beside the airfield from which he began many of his brilliant exploits.


Bristol
BEAUFORTS IN ACTION
Sole Australian and New Zealand Representatives: ROBERT BRYCE & CO. PTY. LTD., MELBOURNE.

Variable Pitch and Constant Speed Airscrews

IN the earlier days of flying all airscrews were of fixed pitch, that is to say, they had no mechanism at the centre of the hub which allowed the blades to be twisted, either in flight or on the ground. But in the early 1930's the variable-pitch airscrew began to appear on some aircraft, until at the present time no aircraft, unless it is of the small low-speed type, is considered worthy of the name unless it is so equipped.

The lower the speed, the less need there is for the variable-pitch airscrew, while the reverse is also true—the higher the speed the more is it desirable, in an engineering sense, to be able to change the pitch.

The necessity for change of blade angle in flight can be explained fairly easily. The wing of an aeroplane moves through the air at a slight angle to its flight path. This is known as the angle of incidence and it is because of this angle that the wing develops "lift."

An airscrew is merely a rotating wing and each section of the blade of the airscrew as it rotates meets the air at an angle of incidence which is called the "pitch angle" at that particular section. The pitch angle is the same as the angle of the blade at that section *if the aeroplane is not moving forward*. But if it is moving forward, the effective pitch angle is somewhat less than the angle of the blade. If the rotational speed of the airscrew is kept constant, then the effective pitch angle becomes less and less as the forward speed increases.

The pitch angle at which the airscrew meets the air determines the amount of thrust which the airscrew develops, just as the angle of incidence of a wing determines the amount of lift which the wing develops. Consequently, an airscrew is designed to have the most efficient pitch angle at each section of the blade, but it can only be designed for this maximum efficiency *at one particular forward speed*. So a fixed-pitch airscrew is designed to be most efficient *for one condition of flight*. For example, it may be designed for cruising speed or maximum speed or perhaps for best rate of climb. Putting it in another way, an airscrew which is right for one condition of flight is wrong for every other.

If an airscrew is designed for an aeroplane with a high speed it must have a large blade angle so that the effective pitch angle at this high speed will have the right value for maximum efficiency. Now, when the aeroplane starts its take-off run the effective pitch angle will be very great since it will then be equal to the blade angle. It may be so great that the blade will be "stalled" just the same as the aeroplane wing can be stalled if its angle of incidence is too great. If so, the thrust developed by the airscrew (on which the aeroplane depends to get it under way) will be very small and the take-off will be very long.

It was this state of affairs, with airscrews stalled or nearly stalled at the take-off, that caused designers to look for a way of reducing the blade angle of the airscrew for the low-speed conditions of flight in order to avoid this inefficiency. So the variable-pitch airscrew was developed with each of its blades attached to a central hub so that they can be rotated and the blade angle reduced when required.

The mechanical complication introduced by the moveability of the blades was very great and years were taken to perfect the mechanism of the variable-pitch airscrew. The first type had only two positions, coarse pitch (with a large angle for high speed) and fine pitch (with a small blade angle for take-off and climb). It could not be set to any position between these two and so had a disadvantage, though it certainly was a great advance on the old fixed-pitch type.

So the next development was the infinitely-variable pitch type which could take up the correct blade angle according to the rate of revolution and the forward speed of the aircraft. This is the constant-speed type. There is, in general, a certain value of engine r.p.m

(Continued on Page 42)

AN EXPERIMENT IN SPINNING

SPINNING (or "auto-rotation," as it is also called) is a phenomenon which dominates the first hours of the pilot's life, and, if he is wise, he never quite forgets about it. For if he does, he may not be allowed to forget for long. To get accidentally into a spin when under 1000 feet is highly dangerous, as it takes some height to recover the necessary margin of speed above stalling and then some more to pull the aeroplane out of the dive. All aeroplanes do not lose the same height per turn of a spin, but a Moth loses about 300 feet, so that gives you some idea of the height needed.

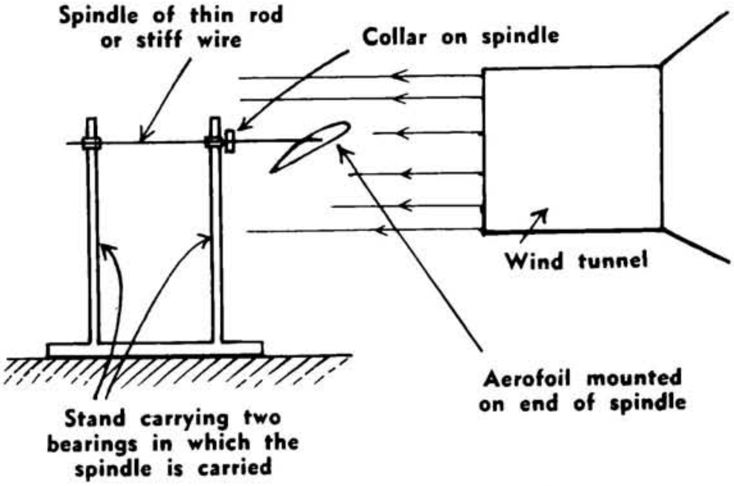
It is well to know the cause of spinning, and this can be demonstrated in the model wind tunnel. The wing must be stalled before the aeroplane can spin, that is essential. Then some slight disturbance must happen—there are always small "bumps" in the atmosphere, however smooth it seems—to cause one wing to drop slightly and the other to rise.

Thus the angle of incidence of the falling wing is increased and that of the other decreased. As the aeroplane is flying at or over the angle of maximum lift, any increase of angle reduces lift, does not increase it. So the falling wing is caused to drop still more and the spin has started. This was explained with a diagram in last month's issue on page 46, but it has been repeated because it is very important and cannot be stressed too much.

To demonstrate spinning, it is necessary to set up a small aerofoil in the wind tunnel first. This should be mounted somewhat as shown on a thin spindle or stiff wire. The spindle is carried in two bearings mounted in supports. It is essential that the bearings have very little friction, but there should not be any need to make up anything elaborate. Two pieces of sheet metal bored to the correct size to take the spindle would do. A collar must be fitted to the spindle to prevent it sliding backward.

The aerofoil must be mounted on its centre line on the spindle, and it is desirable, if you can devise a way, of mounting it so that its incidence is easily adjustable. However, you may not wish to go to as much trouble as this, and the incidence can be altered by having several holes into which the spindle can be fitted.

Set the incidence first to only about 10 degrees. The aerofoil will not rotate, not even if you tap it on one side to give it a start. Then increase the



angle a few degrees and repeat the tap to start it. You will find that it will not start to spin until the incidence is equal to the stalling angle of the aerofoil. When you have set it at that angle it may start to spin itself without any tap, but certainly will go if given a little help. When it is spinning regularly, take a watch and count the spins per minute.

Then increase the incidence and again measure the rate of spinning. You will find it is faster than before, and this is an important fact to remember: the greater the angle of incidence, the faster will the aeroplane spin. So that if you are in a spin and pull the stick back further (and so increase the angle of incidence still more), it will spin faster with you.

But if you do the opposite, put the stick forward, you will reduce the incidence, the plane will gather speed until the wing is unstalled, and it will then stop spinning.

Getting into a spin is very much accentuated by the use of the rudder, particularly the coarse use of it. So if you are spinning, remember to centralise the rudder as well as put the stick forward. If you still have trouble getting out of the spin, use opposite rudder as well as stick forward. If that does not cure the trouble, then it is a very bad aeroplane indeed.

VARIABLE PITCH—Continued

which gives the most efficient engine operation, so that the constant-speed type has engine advantages as well as improved airscrew efficiency.

The mechanism is arranged so that should the engine tend to speed up, the blade angle of the airscrew increases and so increases the load on the engine. This, of course, causes it to slow down again to its proper speed. The reverse also happens, this action being brought about by a very ingenious governor mechanism which changes the angle of the blades by means of an electric motor in the hub or by means of engine oil pressure operating a hydraulic piston and cylinder. Thus the constant-speed type is "right" for all conditions of flight.

A later development still is the "feathering" type. This is simply an extension of the variable-pitch idea so that the blades may be turned edge-on to the airstream if one engine fails. The purpose in so turning them is to put them in the position of minimum drag and so give the crippled aeroplane the best chance of getting back to a landing field. Not only is drag reduced by feathering, but also the angle of yaw of the aircraft, and less rudder has to be held to keep it straight. Another advantage is that the engine is not rotated.

THEORY OF FLIGHT

Wing surfaces and shapes, flaps, axes and planes of reference are dealt with in this, the second article for potential pilots, on the theory of flight. This series is based on Air Force procedure.

THE SLOTTED WING

IN a slotted wing, the slot is formed by a movable auxiliary aerofoil parallel to the leading edge, and its object is to eliminate that instability of flow of the air over the upper surface of the main aerofoil, which occurs at high angles of incidence.

This auxiliary aerofoil is lifted from the nose of the main plane by the action of air forces as the angle of incidence approaches the stalling angle, and provides a slot between the wing and the auxiliary aerofoil.

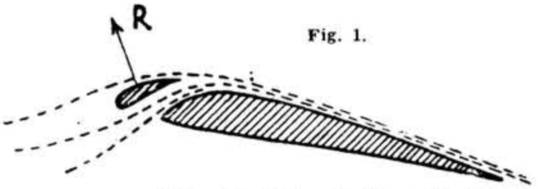


Fig. 1.

The auxiliary aerofoil acts as a small wing, and when the whole wing is at a large angle of incidence, this auxiliary aerofoil is at a small angle, and therefore has a smooth streamline flow over its surface. It deflects the air along the upper surface of the main aerofoil, thus preventing that collapse of the flow which takes place at large angles of incidence. The slot causes the lift to increase with increasing angle of incidence well beyond the ordinary range (Fig. 1), and thereby lowers the stalling speed and the speed at which autorotation can commence.

The effect of fitting slots along the entire leading edge of an aircraft wing is to give a higher maximum lift co-efficient and therefore a decrease in the minimum speed, resulting in a greater speed range.

On the other hand, the high maximum lift co-efficient can only be exploited if the angle of incidence of the wings is increased considerably. (See Fig. 2.) This will necessitate a large angular movement of the fuselage, and if advantage is to be taken of the slots when landing a very high undercarriage will have to be fitted with the attending increase of drag and loss of maximum speed.

Owing to this drawback slots are more generally fitted, to the wing tips only, for the purpose of improving the lateral stability and control of the aeroplane.

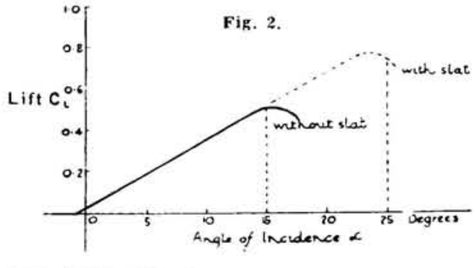
TAPERED WINGS

WITH the advent of the monoplane wing, in which all external bracing is eliminated in order to obviate the drag of exposed struts and wires, it became necessary to increase considerably the thickness of the wings at and near the roots. This was so that spars with deep sections capable of supporting the severe binding moments, due to lift and weight, could be accommodated.

Since a wing of tapered or triangular plan form has much the same lift (other things being equal), as one of the same area but of rectangular plan form, it is clear that the larger root chord of the tapered wing will allow of greater wing thickness and spar depth at and near the wing roots, while retaining the same shape of wing section and aerodynamic characteristics similar to those of the rectangular wing.

The chief merit of tapering the wings of monoplanes is that it enables the materials of construction to be situated where they can best resist the landing moments imposed on the wings in flight, thereby introducing economy in the weight. The amount of taper that may be used is limited because, if excessive, it introduces instability in flight near the stalling speed.

Fig. 2.



THE SURFACES OF AN AEROPLANE

THE ordinary type of aeroplane is composed of wings (aerofoils) to give the necessary lift; a body (fuselage) to hold the pilot, crew, bombs, guns, etc.; an engine and airscrew to propel it through the air; certain subsidiary aerofoils fitted to provide stability and control, and an undercarriage to enable it to attain flying speed before leaving the ground.

The wings are fitted so that the force of lift derived from the whole system (if there is more than one plane) acts very nearly through the centre of gravity of the aeroplane. Otherwise a strong couple would be introduced tending to rotate the aeroplane, which would have to be resisted by the controlling surfaces.

(Continued on page 46)

Theory of Flight—Contd.

The lift is composed of the resolved components of an infinite number of small forces acting at all points of the surface. If these are combined and considered as equivalent to a single force, the point where the line of action of this force cuts an arbitrarily chosen surface in the aerofoil or system of aerofoils is known as the "centre of pressure." This point will be frequently referred to in considering forces on an aerofoil.

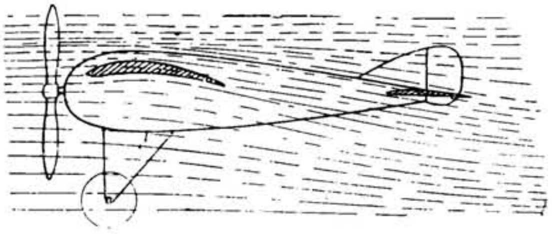


Fig. 3.

For a given aerofoil the distance of the centre of pressure from the leading edge depends on the angle of incidence employed.

For a flat plane, as the angle of incidence is decreased, the centre of pressure moves towards the leading edge; but with an aerofoil, the section of which is curved (with respect to the direction of flow) and the concave side of which is taking the positive pressure exerted by the air flow, the centre of pressure moves towards the trailing edge as the angle of incidence is decreased.

FLAPS

FLAPS are control surfaces incorporated in the trailing edge of a wing and sometimes extending beneath the fuselage. There are many variations from the simple hinged flap, which is similar to an aileron and generally situated between the aileron and the wing root.

The function of the flaps is to increase the lift and the drag of the wing, when they are deflected or lowered and thereby enable the aeroplane to glide down a steeper path and land at a lower speed than would be possible without their aid.

The increase of drag when flaps are lowered rather neutralises the advantage they would otherwise have for take-off, and as a consequence during take-off they are not lowered through the large angle that is used during landing.

By suitable arrangement of the hinge mechanism of one type of flap, a slot is opened between the forward edge of the flap and the aft edge of the wing as the flap is lowered. This causes a large increase of lift, and only a slight increase of drag for moderate deflections of the flap, conditions which are suitable for take-off. Whereas a further deflection causes additional drag without loss of lift, conditions suitable for landing, the flaps (on the inner portions of the port and starboard wings) are connected to the same control mechanism and are raised and lowered together so that both wings receive the same increment of lift and drag.

TAIL-PLANE FUNCTIONS

THE variation of the centre of pressure (C. of P.) of the main planes causes the aeroplane to be unstable. If, owing to some disturbance, the incidence is increased temporarily, the C. of P. moves forward, and introduces a couple which tends to turn the aeroplane in a direction which still further increases the incidence by depressing the tail.

Similarly, if the incidence is momentarily reduced, the travel of the C. of P. backwards will tend to reduce the incidence still further, and cause the aeroplane to dive. To overcome this and to give stability, a small subsidiary aerofoil called the tail-plane is added some distance behind the centre of gravity (C. of G.) of the aeroplane.

This is set normally so that the couple due to the lift or down load on the tail-plane balances out the resultant couple due to thrust and drag, lift and weight. The resultant force on the whole when in steady flight should be zero.

If due to some disturbance, such as a bump, the incidence of the main planes is increased, the effect will be for the whole aircraft to rotate in such a way that the tail will move downwards relative to the main planes. This will increase the incidence at which the tail-plane meets the air-flow, thereby increasing its lift and tending to right the aircraft.

Conversely, a bump or down gust which reduces the incidence of the main planes will move the tail-plane upwards. A down load (or, at least, a reduction of the up load necessary to give balance) on the tail will ensue, and the aircraft will tend to be brought back to its original altitude. The tail-plane is fitted in the position shown in Fig. 3.

DOWNWASH

THE air passing over the wings of an aeroplane is deflected downwards from its original direction, the angle through which the air is turned being called the angle of downwash. One effect of downwash is to alter the angle of incidence of the air flow over the tail-plane, as shown in Fig. 3.

AXES OF AN AEROPLANE

The fixed axes of an aeroplane are as follows:—

(a) THE LONGITUDINAL AXIS is a straight line in the plane of symmetry through the centre of gravity, measured fore and aft. In general theoretical discussions of the motions of an aeroplane this may be taken as parallel to the air screw axis. An angular motion about the longitudinal axis is called "rolling." A complete turn about this axis takes place during a roll; but it should be noted that in this manoeuvre the rotation is not uniform, and has components about other axes.

(b) THE NORMAL AXIS is a straight line, through the centre of gravity, in the plane of symmetry, at right angles to the longitudinal axis. Angular motion about the normal axis is called "yawing."

(c) THE LATERAL AXIS is a straight line through the centre of gravity normal to the plane of symmetry. The lateral axis may be taken as parallel to the line joining the wing tips, and, when regarded from the direction of motion, the positive branch of the axis is to starboard. An angular motion about the lateral axis of an aeroplane is termed "pitching."

When the longitudinal and lateral axes are horizontal the normal axis is vertical. A complete revolution about the lateral axis is called a loop. The loop commonly practised is in the positive direction of rotation.

Axes that change direction with change of altitude of aircraft are:—

(a) THE DRAG AXIS: A straight line which passes through the centre of gravity and is parallel to the direction of wind (air flow).

(b) THE LIFT AXIS: A straight line which passes through the centre of gravity, which is in the plane of symmetry, and is perpendicular to direction of the wind. The positive direction is upwards in ordinary straight flight.

(c) CROSS-WIND AXIS: A straight line through the centre of gravity at right angles to the lift and drag axes. The positive direction is to port.

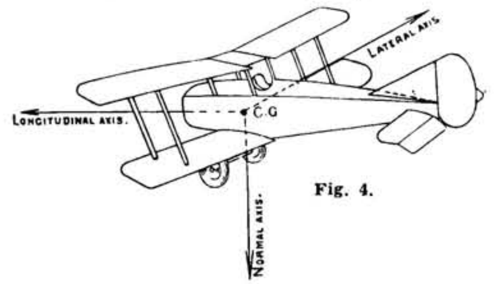


Fig. 4.

PLANES OF REFERENCE

THE evolutions of an aeroplane in the air are considered in three planes. These are fixed with reference to the aeroplane, and not to the ground, and are as follow:—

(a) THE YAWING PLANE is the plane in which lie the longitudinal and lateral axes of the aeroplane. It is perpendicular to the normal axis.

(b) THE LOOPING PLANE is the plane in which lie the longitudinal and normal axes. It is perpendicular to the lateral axis.

(c) THE ROLLING PLANE is the plane in which lie the lateral and normal axes. It is, perpendicular to the longitudinal axis.

U.S. BOMBERS

Dear Sir,—

As a new reader of your journal I unfortunately have missed most of the silhouettes of aircraft. But would it be possible for you to publish a list of American bombers, dive bombers, patrol bombers and pursuits?—T.J. (Surrey Hills).

Sorry you missed the silhouettes, but we will be republishing them with others in the future. List of U.S. Army pursuits was given in answer to another reader. Here are the main U.S. bombers:

ARMY:

DB-7, Douglas. R.A.F. call it Havoc as night fighter and Boston day fighter-bomber.

B-18A, B Douglas (R.A.F. Digby).

A-24 Douglas Dive Bomber.

B-25 North American medium bomber.

B-26 Martin medium bomber (R.A.F. Marauder).

167-B4 Martin (R.A.F. Maryland) medium bomber.

72 Vultee Dive Bomber (R.A.F. Vengeance).

B-17 E, D, F, Boeing (Flying Fortress).

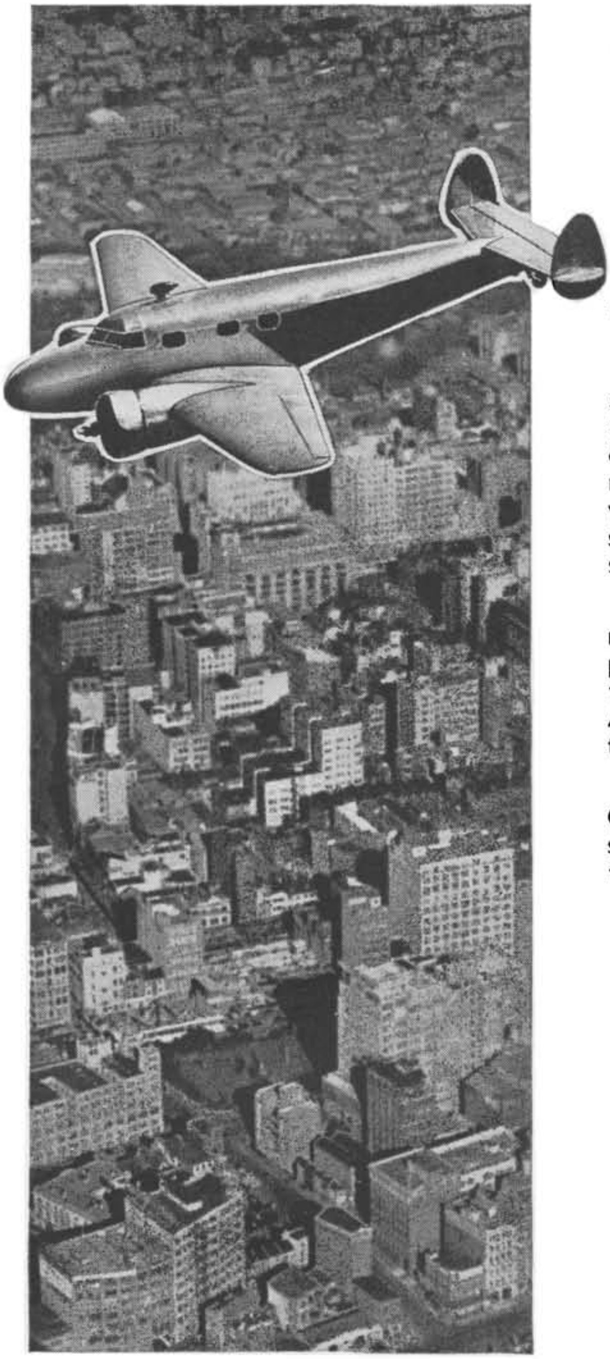
B-24 B Consolidated heavy bomber (R.A.F. Liberator).

NAVY PATROL BOMBERS:

PBY-5 Consolidated (Catalina).
PB2Y-2 Consolidated.
PBM-2 Martin.
PB2M-1 Martin.
XPBB-1 Boeing.

Is the Martin Marauder used as a torpedo bomber?

Yes. Lieut Gen. Arnold announced recently that torpedoes from B-26 sank a Jap cruiser off Aleutian Islands.



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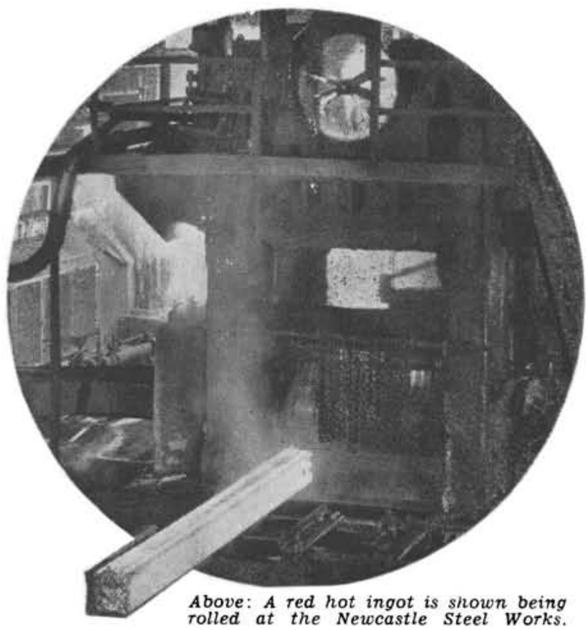

Above: A red hot ingot is shown being rolled at the Newcastle Steel Works.

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